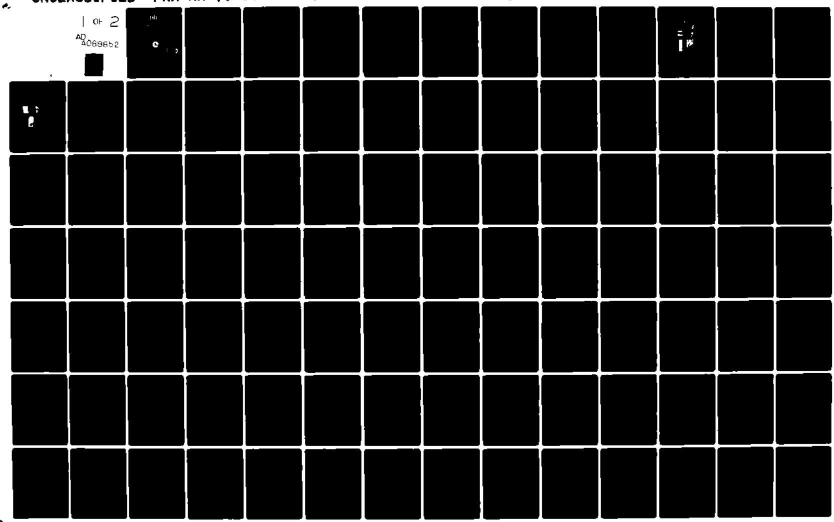
AD-A088 852 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 17/7
TEST AND EVALUATION OF TEXAS INSTRUMENTS SMALL COMMUNITY MICROW--ETC(U)
MAY 80 J WARREN

UNCLASSIFIED FAA-NA-79-34 FAA-RD-80-49 NL

1 OF 2
AD A088852



Report No. FAA-RD-80-49
FAA-NA-79-34

TEST AND EVALUATION OF TEXAS INSTRUMENTS SMALL COMMUNITY MICROWAVE LANDING SYSTEM

John Warren

NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER
Atlantic City, N. J. 08405

FINAL REPORT

MAY 1980

Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.

Prepared for

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D. C. 20590

NOTICE

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-RD-80-49		

4. Title and Subtitle	5. Report Date
TEST AND EVALUATION OF TEXAS INSTRUMENTS SMALL COMMUNITY MICROWAVE LANDING SYSTEM.	May 1980
	6. Performing Organization Code
7. Author(s) John Warren	8. Performing Organization Report No. FAA-NA-79-34
9. Performing Organization Name and Address ~~Federal Aviation Administration~~ National Aviation Facilities Experimental Center Atlantic City, New Jersey 08405	10. Work Unit No. (TRAIS) 11. Contract or Grant No. 075-725-400
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Systems Research and Development Service Washington, D.C. 20590	13. Type of Report and Period Covered Final rept. February 1977-August 1978 ~~14. Sponsoring Agency Code~~

15. Supplementary Notes

12 169

16. Abstract

The purpose of this program was to test the Texas Instruments (TI) model of a time reference scanning beam (TRSB) known as the "Small Community Airport Microwave Landing System" (SCAMLS) for conformance with the contractual proportional coverage and accuracy specifications. The TI SCAMLS is a prototype system intended to provide approach and landing guidance in a low-cost package to relatively low-density, short-runway feeder and general aviation airports. Flight and static tests determined the azimuth and elevation angular errors of the system. Results indicate that the guidance signals from the TI SCAMLS were within contractual specifications.

17. Key Words	18. Distribution Statement
Time Reference Scanning Beam Microwave Landing System Small Community System	Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	167	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10 286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

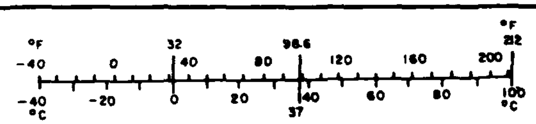


TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

PURPOSE.

The purpose of this program was to test the Texas Instruments (TI) model of a time reference scanning beam (TRSB) known as the "Small Community Airport Microwave Landing System" (SCAMLS), for conformance with the contractual specifications.

BACKGROUND.

In accordance with the "National Plan for the Development of the Microwave Landing System," published in July 1971, the United States (U.S.) MLS program is a joint, interservice Department of Transportation (DOT) Department of Defense/National Aeronautics and Space Administration (NASA) development activity, with DOT Federal Aviation Administration (FAA) designated as the lead agency. The National Plan initiated a three-phase, multiyear development program to identify and demonstrate a new approach and landing system which is intended to eventually replace the instrument landing system (ILS), and is designed to meet both civil and military operational needs as stated by Special Committee (SC)-117 of the Radio Technical Commission for Aeronautics (RTCA) in December 1970.

Phase I of the program involved technique analysis and contract definition. During this phase, it appeared that both the TRSB and Doppler techniques had the potential for meeting the full range of operational requirements. Phase II, the feasibility demonstration phase, involved design, fabrication, and demonstration of both the Doppler and scanning beam techniques using systems installed at the FAA's National Aviation Facilities Experimental Center (NAFEC) and NASA's Wallops Island test facilities. The test results from phase II were thoroughly analyzed in December 1974 by an interservice government committee, with full-time participation of international MLS experts from Australia, France, and the United Kingdom and part-time participation from other countries. This committee selected the TRSB technique over the Doppler technique for further development and, as a result, the TRSB was submitted to the International Civil Aviation Organization (ICAO) as a candidate for international adoption. Phase III was concerned with fabrication of prototype TRSB equipment in the different configurations necessary to show compliance with the requirements of all major user groups. One of these configurations was the TI SCAMLS intended for short-runway operations typical of general aviation requirements and the subject of this report.

GENERAL SYSTEM DESCRIPTION.

All configurations of the phase III TRSB MLS (which is an air-derived system) operate at C-band (5031.0 - 5090.7 megahertz (MHz)). The airborne receiver/processor calculates a vertical angle from the elevation transmitting antenna, assumed relative to the horizontal plane, tangent to the runway surface near the glidepath intercept point (GPIP), and calculates a horizontal angle relative to the runway centerline from the azimuth transmitting antenna. In the TRSB technique, the airborne angle information is derived by precisely timing the

passage of narrow fan beams which are scanned sequentially TO-FRO at high rates through the azimuth and the elevation coverage volumes. The time interval between passage of the TO and FRO beams is directly proportional to the azimuth and elevation of the receiver and, therefore, the approach aircraft. Both the azimuth antenna and elevation antenna have a transmitter power output of 20 watts and respective gains of 14.5 and 16.5 decibels relative to an isotropic (dBi) source, thus providing usable guidance signals out to a range of 15 nautical miles (nmi), assuming a receiver sensitivity of -100 decibels per milliwatt (dBm).

Azimuth antenna beam width is the major factor in tailoring a system to a particular runway length in order to prevent inbeam multipath between the azimuth unit and runway threshold. The distance from the azimuth antenna to the landing threshold is specified such that one beam width is approximately 300 feet in the lateral or crossrunway direction. For example, the TI SCAMLS azimuth antenna has a 3° beam width, therefore, the azimuth-threshold distance should be less than approximately 6,000 feet, which for this configuration was 5,827 feet. Large vertical reflection surfaces (e.g., 50 feet) such as hangers or other ground-support building are required, by the current obstruction criteria, to be at least 850 feet from an instrument runway. If this lateral separation represents several beam widths (i.e., more than two beam widths) of the azimuth antenna, no inbeam multipath from these sources will be generated in the centerline approach region.

Observing the "300-feet" rule when siting the azimuth subsystem will insure more than two beam widths separation, and the centerline region will be free of inbeam reflections from vertical reflectors. The airborne systems have been designed to reject out-of-beam multipath so no consideration of this phenomenon is necessary when considering system installation.

One of the design considerations operative in the TI SCAMLS is the concept of modularity, in which the system can be configured or upgraded to suit the changing needs of a particular user by adding other subsystems such as flare, missed approach, or range, as needed at a later time. In addition, most of the electronics used in the azimuth and elevation units can be interchanged, but with some system monitor parameter changes.

TEXAS INSTRUMENTS SMALL COMMUNITY MLS

The TI SCAMLS is a prototype of the system intended to provide approach and landing guidance in a low-cost package to relatively short runways, typical of low-density feeder and general aviation airports, while retaining compatibility with more expanded versions of TRSB and allowing for growth potential. The system error budget and monitor are designed to support at least category I instrument flight rules (IFR) operations (200-foot ceiling and 2,400-foot runway visual range) on runways up to 5,000 feet.

The TI SCAMS is comprised of two subsystems: an azimuth unit and an elevation unit. The specifications for each of the units were provided with the equipment. Each unit is completely self-contained within its climate-controlled antenna case and does not require additional equipment shelters. Figure 1 shows the azimuth guidance set which consists of the azimuth electronics cabinet and the azimuth antennas.

The azimuth unit uses a bifocal pillbox feeding a flat-plate array of 32 waveguides with 37 "C"-shaped slots in each waveguide spaced so as to form a vertical fan beam (3° beam width). Vertical coverage is provided from 1° to 15° in elevation with a sharp underside cutoff (13 decibles (dB)/degree). This prototype antenna scans a beam from left 12° through centerline to right 12° providing proportional guidance from left 10° to right 10°. Built-in sector clearance antennas provide full fly-left and full fly-right coverage from left 40° to left 10°, and right 40° to right 10°. The same antennas provide right and left side lobe suppression (SLS) signals except that output power is reduced by 6 dB relative to the clearance signals. The back SLS antenna covers the region -90° through 180° to +90°, with 3 dB more power output than the left-right SLS signals.

A typical elevation pattern of the azimuth antenna is shown in figure 2, and the azimuth coverage of the various azimuth antenna patterns is shown in figure 3. The scanning rate of the azimuth beam is 13.5 hertz (Hz). The identification (ID) antenna has the same gain and input power as the clearance antennas and coverage is from ±40° in azimuth and 1° to 15° in elevation.

The small community system transmits the following data from the azimuth unit:

Airport identification (morse code)

Azimuth status (category I or unusable)

Elevation status (category I or unusable)

Azimuth offset (lateral distance from runway centerline)

Elevation offset

Elevation antenna height

Elevation to threshold distance

Airport identification (digital)

Runway identification

Minimum glide slope

Figure 4 shows the elevation guidance set consisting of the elevation electronics scanning antenna (40.5-Hz rate), the ID sector antenna, and the

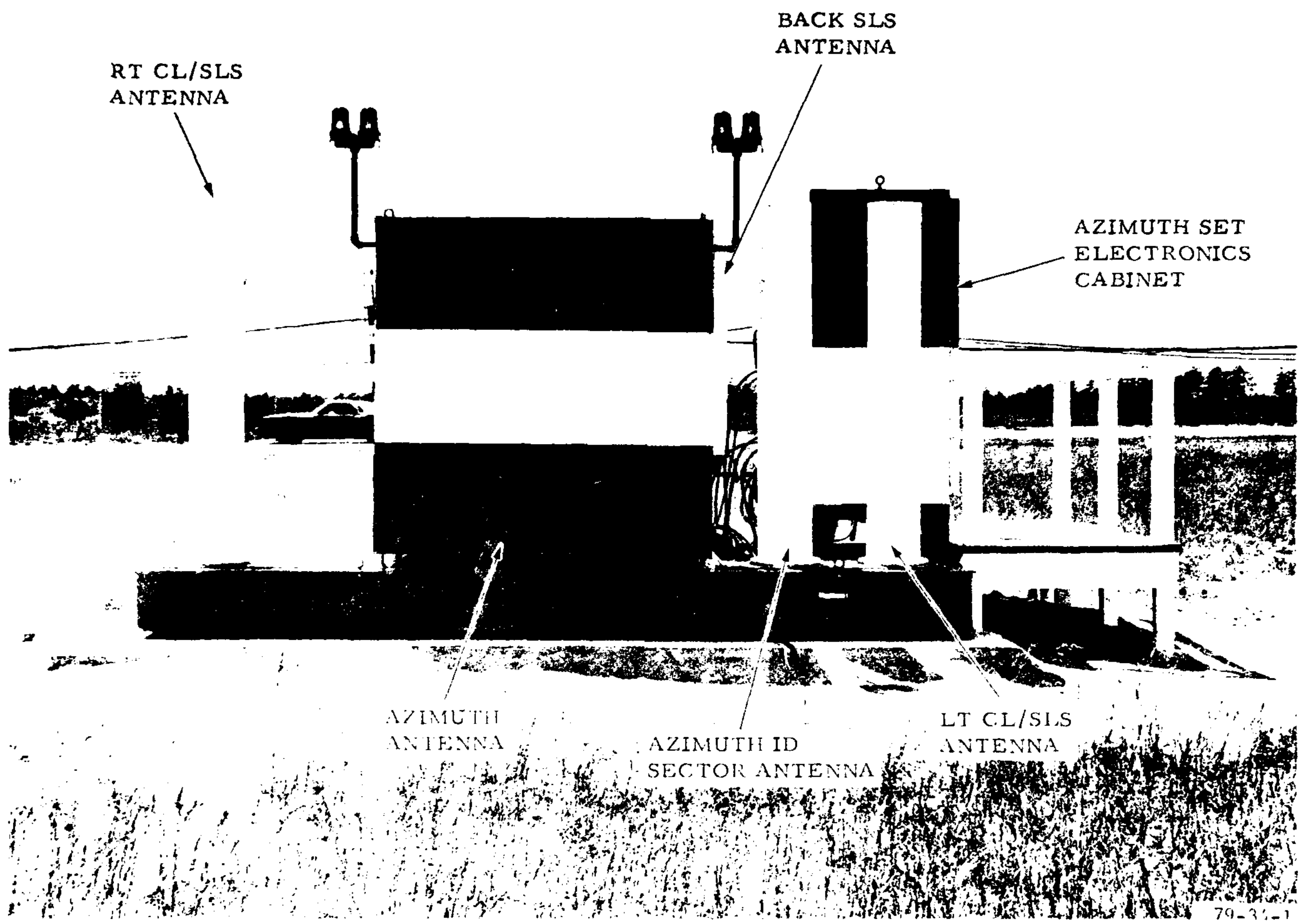


FIGURE 1. AZIMUTH GUIDANCE SET

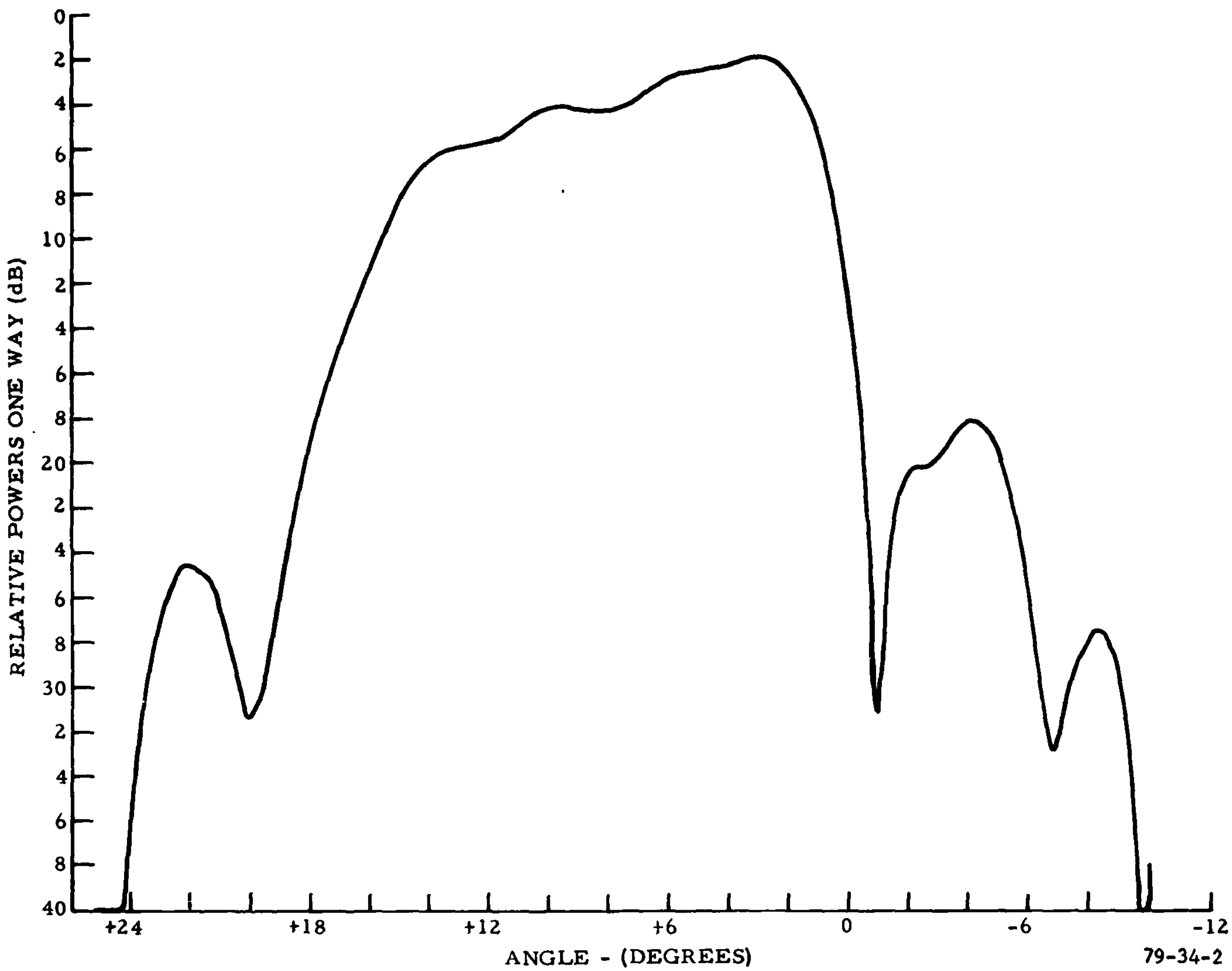


FIGURE 2. TYPICAL ELEVATION PATTERN OF AZIMUTH GUIDANCE SET

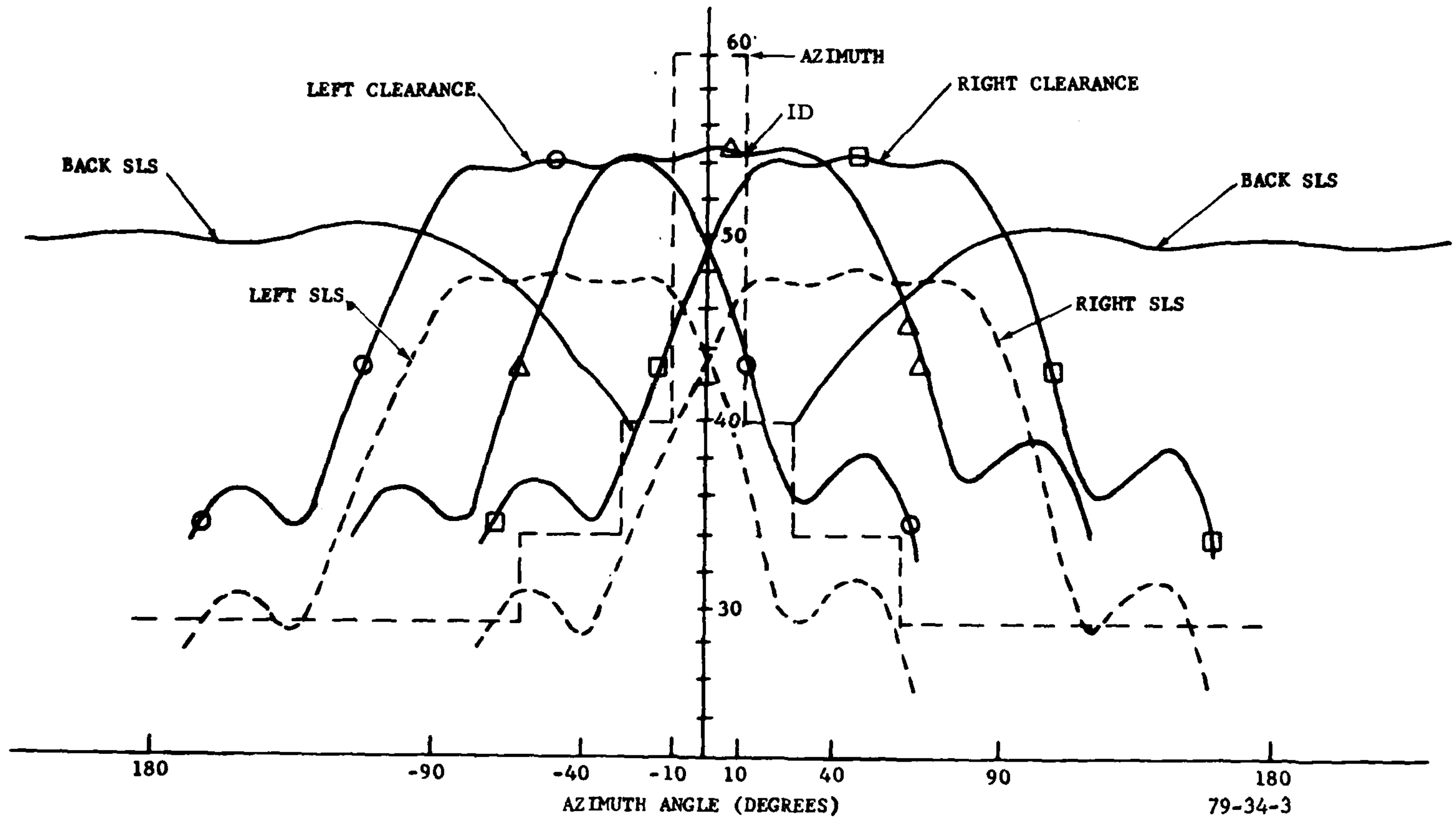


FIGURE 3. AZIMUTH ANTENNA PATTERNS OF AZIMUTH GUIDANCE SET

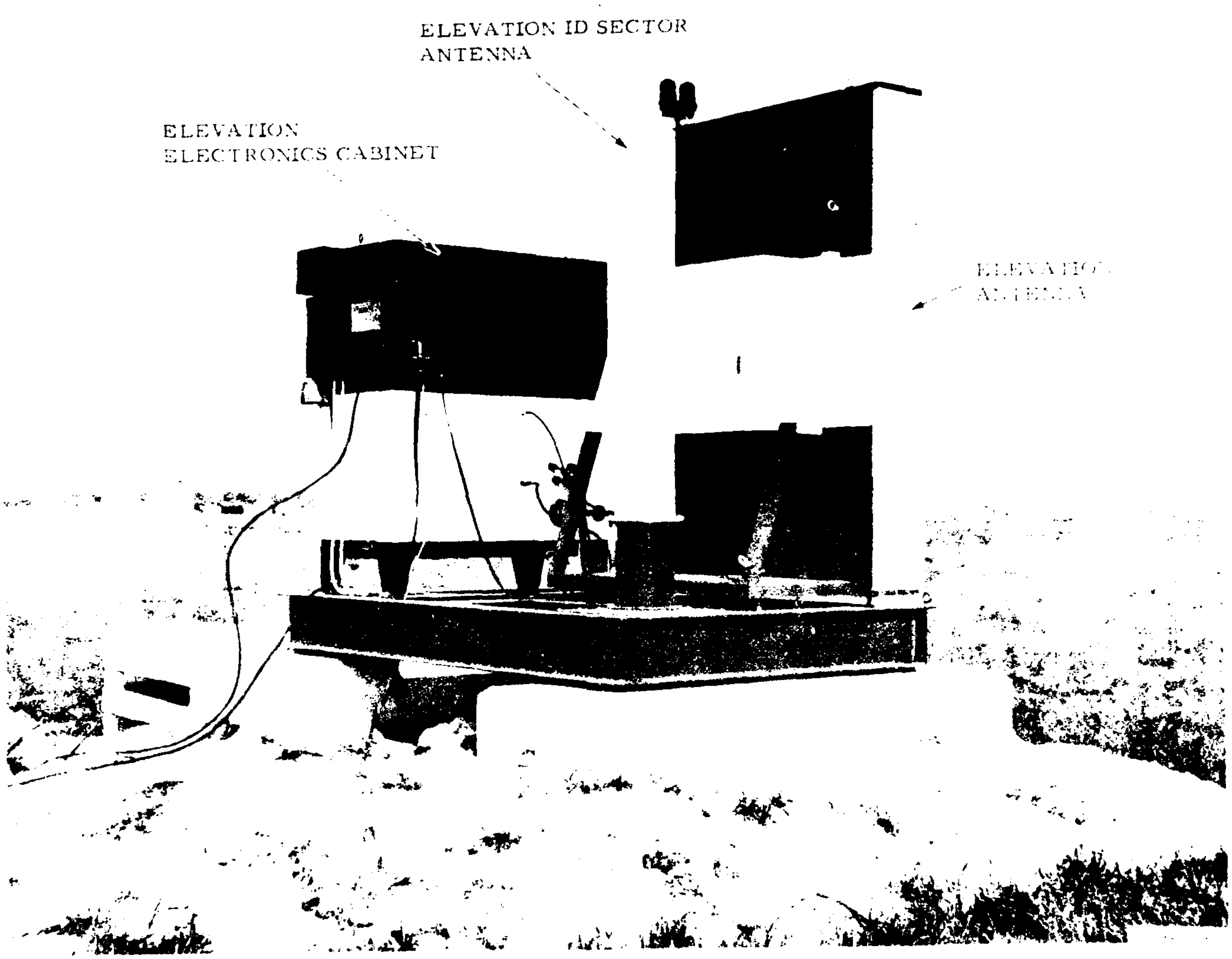


FIGURE 4. ELEVATION GUIDANCE SET

electronics cabinet. The scanning antenna is a bifocal pillbox array consisting of 12 monopoles feeding a subreflector which feeds a primary reflector. The antenna radiates a beam 2° in width which can scan from 1° to 15° in elevation. This antenna transmits a differential phase shift keying (DPSK) signal which conditions the airborne receiver to receive the scanning beam that follows. Figure 5 shows the azimuth pattern of the elevation antenna. The TI SCAMLS summary parameters are listed in table 1.

SPECIFICATIONS.

The TI SCAMLS was subjected to numerous flight and static tests as required by the phase III test plan for the U.S. MLS. The object of these tests was to provide data to determine if the systems were operating within the accuracy and coverage limits specified by the phase III TRSB contracts. For the small-community system, specification FAA-ER-700-04 applies; degradation factors appear in specification FAA-ER-700-07.

Measurements were made to determine the azimuth and elevation angular errors in the system (i.e., the difference between the angle received and processed by the airborne receiver and the true angle at the same instant in time). The guidance signals are subject to propagation distortion and processing inaccuracies introduced in both the ground and airborne equipment. These errors fall into two categories, constant bias errors and cyclical errors of all frequencies. These errors interact with the flight control system in a variety of ways, resulting in two general types of guidance errors: path-following error (PFE) and control motion noise (CMN).

PFE encompasses the steady-state bias and low-frequency cyclical error components whose frequencies lie in the 0 to 2.34 radians/second range (6-dB point) for elevation and the 0 to 0.78 radian/second range (6-dB point) for azimuth. These errors are of low enough frequency for the aircraft to physically track and have a measurable effect in terms of deviations from the desired track. The transfer function of the analog low-pass filter used to extract this error from the raw data is:

$$H(S) = W_n^2/(S^2+2W_nS+W_n^2)$$

where, for $AZ:W_n = 0.78$ rad/sec and
for $EL:W_n = 2.34$ rad/sec

Implementation of this analog filter for computer processing is based on approximating an integral by the trapezoidal rule and Z-transform theory ("Digital Signal Processing," A. Oppenheim and R. Schafer). By making the following substitutions, the difference equation for the corresponding digital filter will result:

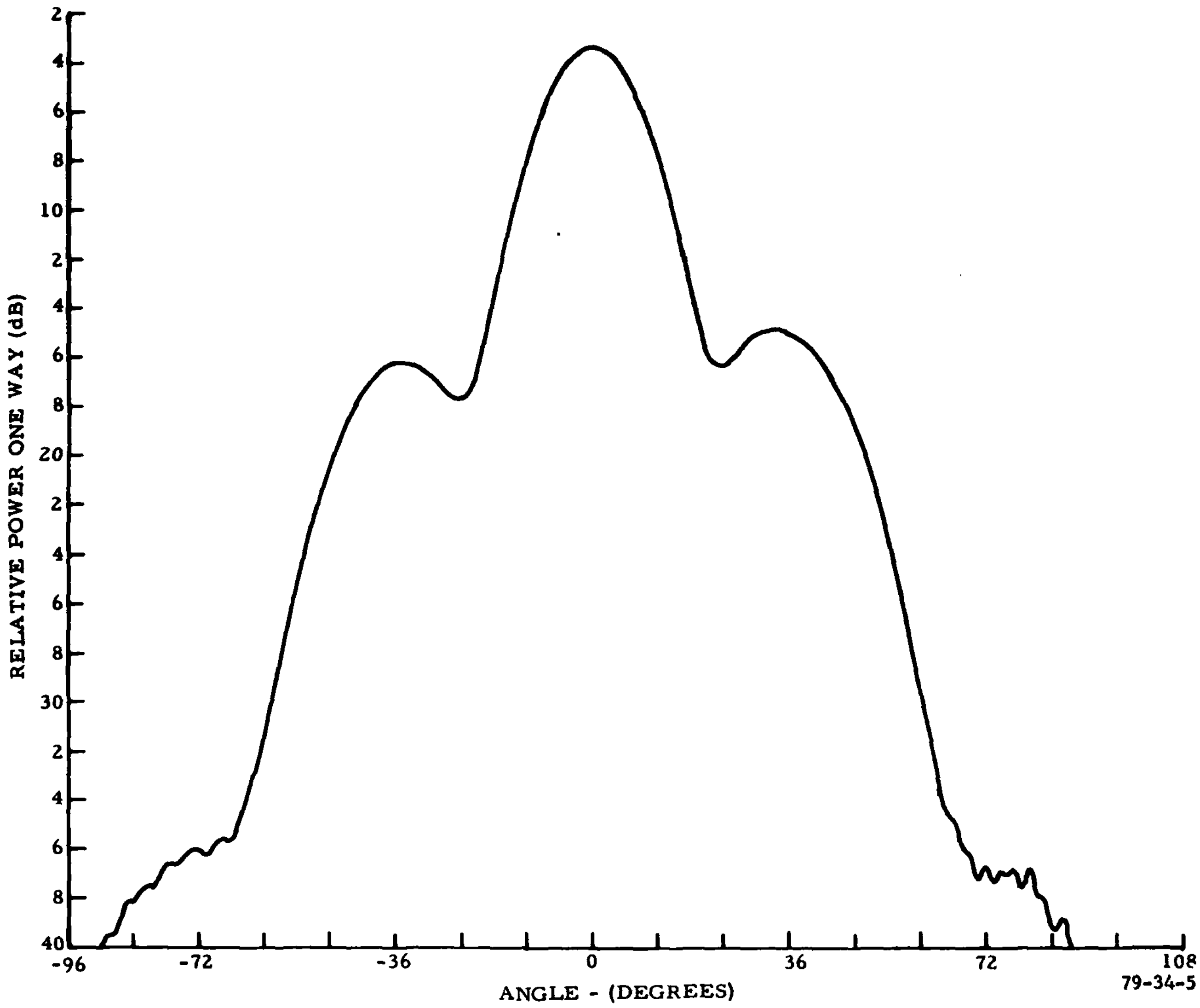


FIGURE 5. TYPICAL AZIMUTH PATTERN OF ELEVATION ANTENNA

TABLE 1. TI SCAMLS SUMMARY PARAMETERS

	Antenna Type	Beamwidth (Degrees)	Frequency (MHz)	Physical Aperture (Wavelengths)	Coverage	Gain (dBi)	Trans Power (Watts)	No. of Output Elements	Scan Rate (Hz)
Azimuth	Rotman Lens	3	5059.8	25 by 26	±10° Prop. 10-40° Clearance 1-15° E-Plane	14.5	20	1,184 Slots	13.5
Elevation	Bifocal Pillbox	3	5059.8	5 by 34	1.9-10.7° Prop ±40° H-Plane	16.5	20	12	40.5

$$S = \frac{2}{T} \frac{(1 - Z^{-1})}{(1 + Z^{-1})}$$

$$Y(Z) = H(Z)\ X(Z)$$

$$X_{n-1} = X(Z)Z^{-1}$$

$$Y_{n-1} = Y(Z)Z^{-1}$$

where the Y's are the calculated filter outputs and the X's are the measured input values.

T is the sampling period (assumed constant)

$$Y_n = (4+4W_nT+W_n{}^2T^2)^{-1} \left\{(W_n{}^2T^2)\ (X_n+2X_{n-1}+X_{n-2}) + (8-2W_n{}^2T^2)Y_{n-1}-(4-4W_nT+W_n{}^2T^2)Y_{n-2}\right\}$$

AZ: $T = 2/13.5$
EL: $T = 2/40.5$

The filter is started by initializing all values to the first angular error difference measurement.

After the data are filtered, they are compared to the 2-sigma maximum specification limits. The equations representing the error are:

$$\text{Azimuth: Error} = \pm \left[(0.0035R+0.33)\ (\theta_A/60+1)\ (\theta_{E1}/6-0.5)\right]$$

$$\text{Elevation: Error} = \pm \left[(0.004R+0.16)\ (0.16\theta_{E2}+0.6)\right]$$

Where

R = Range in nautical miles (nmi) from decision window

θ_{E1} = Elevation angle from the AZ phase center

θ_{E2} = Elevation angle from the EL phase center

θ_A = Azimuth angle from the AZ phase center

$(\theta_{E1}/6-0.5) = 1$ for $\theta_{E1} < 9°$

$(0.16\theta_{E2}+0.6) = 1$ for $\theta_{E2} < 2.5°$

Note that the PFE error from the azimuth unit may degrade with range, azimuth, and elevation angle. However, the PFE error from the elevation unit may degrade only with range and elevation angle.

CMN encompasses the higher frequency error components in the 0.3 to 10 radian/second range for azimuth and 0.5 to 10 radian/second range for elevation.

These errors are generally of a frequency too high for the aircraft to physically track, but low enough for the control system to respond to. Thus, CMN results in rapid small-amplitude control surface wheel and column motions and is undesirable in that it contributes to control surface and servo wear and diminishes flight crew confidence by presenting them with a "shaky stick." The transfer function of the bandpass filter used to extract the CMN error from the raw data is:

$$H(s) = \frac{S}{(S+W_1)} \quad \frac{W_2}{(S+W_2)}$$

AZ: $W_1 = 0.3$ rad/sec, $W_2 = 10$ rad/sec (3-dB points)

EL: $W_1 = 0.5$ rad/sec, $W_2 = 10$ rad/sec (3-dB points)

The corresponding digital filter difference equation is:

$$Y_n = (4 + 2W_1T + 2W_2T + W_1W_2T^2)^{-1} \left\{ 2W_2T\ (X_n - X_{n-2}) + (8 - 2W_1W_2T^2)\ Y_{n-1} - (4 - 2W_1T - 2W_2T + W_1W_2T^2)\ Y_{n-2} \right\}$$

The equations representing the CMN error for each unit are the same; i.e.,

$$\text{Error} = \pm\ (0.005R+0.1)$$

The accuracy data for the azimuth and elevation units are valid only for their respective coverages, which are relative to the phase center of each unit. The coverage of the azimuth unit is 15 nmi in range, ±10° in azimuth angle, and 1° to 15° in elevation. The coverage of the elevation unit is 15 nmi in range, ±10° in azimuth (relative to the azimuth site), and 1.9° to 10.67° in elevation. The minimum range for which each unit is valid occurs at the decision window which is located along a 2.5° glide slope from the elevation unit and 150 feet above runway threshold. This point was located 2,209 feet from threshold.

The calculated accuracy specification limits for the three types of flight patterns flown against the TI SCAMLS are shown in appendix C. Appendix C contains six graphs: an azimuth and elevation graph for each of three types of flight profiles, glideslopes, radials, and orbits. The curves are plotted only out to 8 nmi because tracking beyond this point was not considered highly accurate, usually due to weather conditions during the flights.

SYSTEM INSTALLATION AND CHECKOUT.

The TI SCAMLS system was delivered to NAFEC on February 16, 1977, and installed for service to runway 26. The azimuth unit was located near the stop end of runway 8/26 along the centerline and 5,828 feet from threshold. The elevation site was located alongside the runway 1,226 feet from threshold and 325 feet laterally from centerline.

During system checkout various problems were encountered. It was found that some of the power monitors that measure incident and reflected power to each antenna were apparently damaged in shipment and had to be replaced. During the summer of 1977, it was found that the solid state hardware in the main electronic cabinet was overheating, causing intermittent failures, and it was necessary to install air-conditioning inside the azimuth and elevation units. The original monitor antennas were changed in June 1978 to small horns based on extensive data obtained at Crows Landing, California. Tests on the TI Basic Narrow MLS there indicated that large errors could be caused by signal blockage from the original monitor large-aperture antennas.

The major problem with the TI system was found to be the variation of elevation angle with the time of day. Temperature probes were placed inside the antenna cabinet, and it was found that uneven heat distribution on the printed circuit boards caused the variation. The solution, implemented in March 1978, was to place fans inside the cabinet in order to distribute the heat equally.

The severe winter of 1977-1978 precluded the resolution of minor problems until a personnel tent was installed over the azimuth and elevation electronics units. Some of the problems were: hex switches in the beam steering unit not making good contact, noise on the antenna switching unit line, and noise in the air traffic control (ATC) remote status display unit.

In April 1978, a remote maintenance monitoring capability was developed to display 25 parameters sent over standard telephone lines to an ICAO conference in Montreal.

TEST PROCEDURES

Data were collected in two ways: static data using an instrumented mobile test van with an adjustable antenna mast, which could be extended to 68 feet while carefully positioned over surveyed test points; and flight data using NAFEC's Aerocommander (N-50) and the NAFEC theodolite tracking system for space positioning. Block diagrams of the data collection systems used in the static and flight tests are shown in figures 6 and 7.

For the static tests, the mobile test van antenna mast was positioned over each surveyed point and a sample of data taken for each desired antenna height from the TRSB receiver/processor. The value of each data sample, along with the error of each sample, population mean, and the standard deviation, were then transferred to cassette tape for storage and graphical display.

For the dynamic or flight tests, accuracy data were collected on a series of straight-in, level runs and constant elevation angle approaches using azimuth and elevation guidance from the TRSB receiver driving a standard ID-248 cross-pointer display. Constant-radius orbital runs through the coverage volume were accomplished for both accuracy and coverage measurements using range

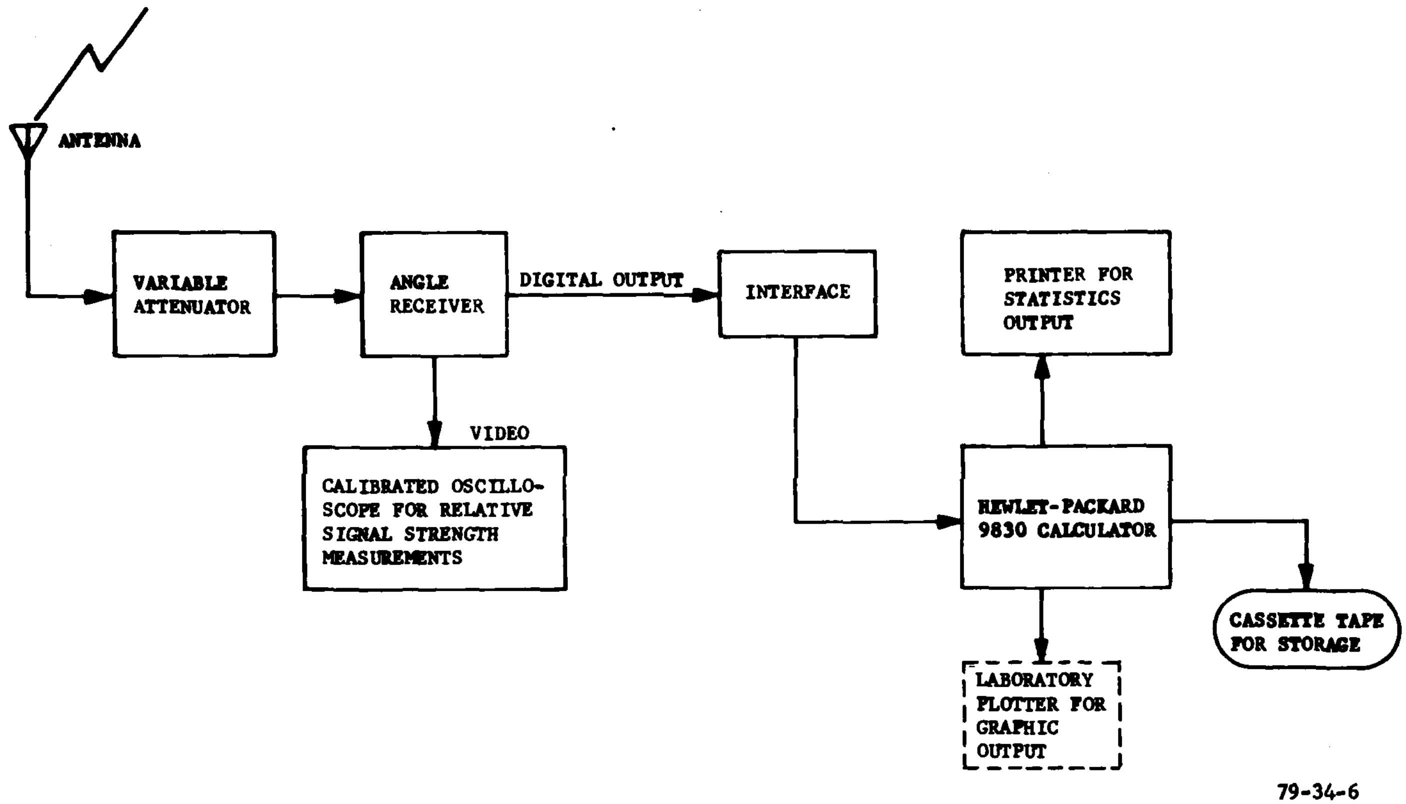


FIGURE 6. STATIC DATA COLLECTION SYSTEM

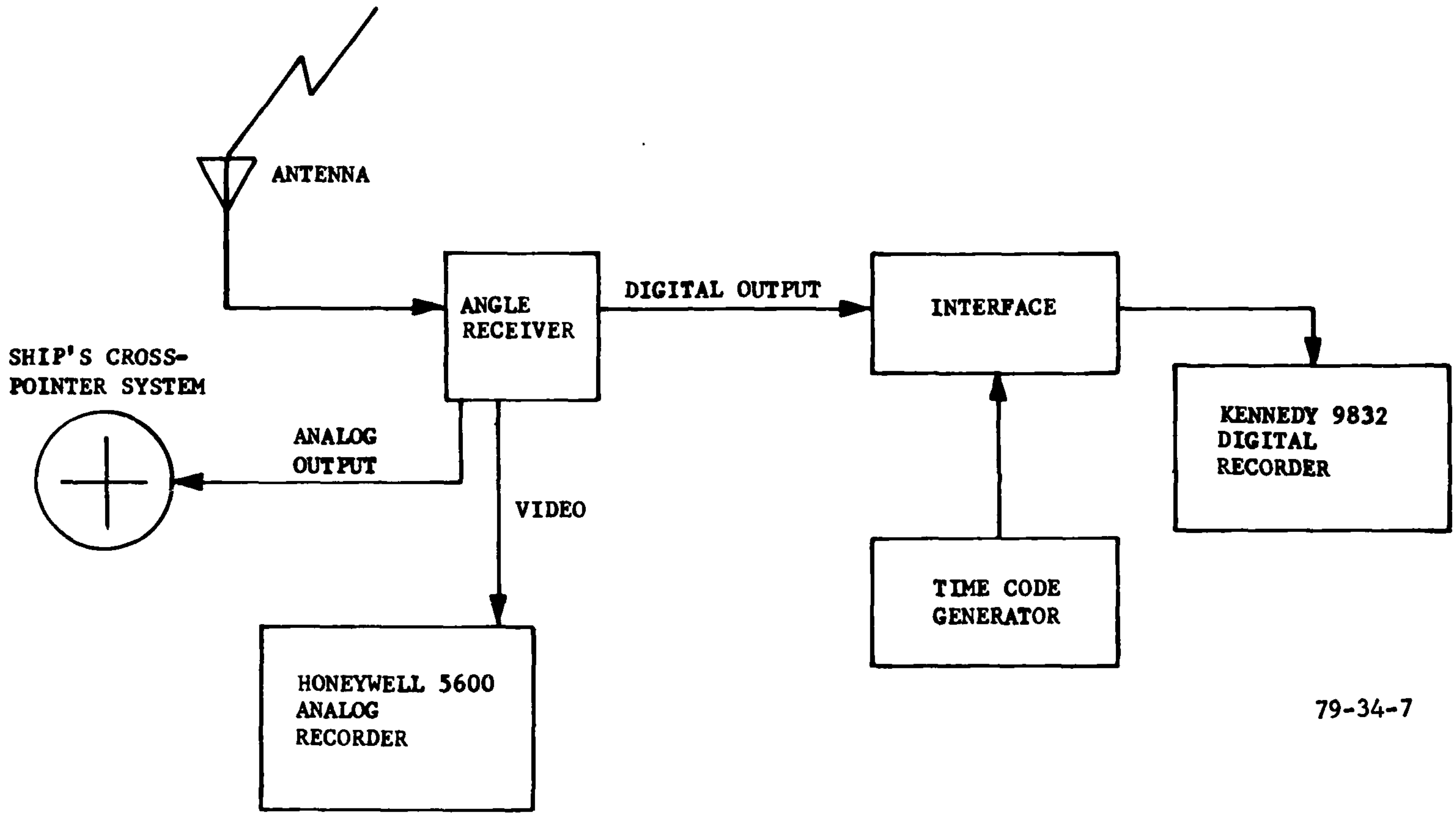


FIGURE 7. AIRBORNE DATA COLLECTION SYSTEM

guidance from the Atlantic City (ACY) very high frequency omnirange tactical air navigation station (VORTAC) and barometric altitude. All flights were tracked by the NAFEC theodolite system, which was time synchronized with the airborne data collection system (the tracker-derived position became the standard against which the TRSB-derived position was compared for the resulting accuracy and coverage data). Upon completion of the flight, the TRSB airborne tape was time merged with the tracker/tape to determine the guidance errors over the flightpath according to the relationship: Error = receiver angle minus tracker angle.

DATA ANALYSIS

FLIGHT DATA.

The flight data (appendix A) are separated by flight patterns; i.e., both the azimuth and elevation data for a particular flight pattern are presented in a series of six plots, three for azimuth and three for elevation. Each group of three plots is arranged as follows: (1) MLS angle receiver output and tracker reference position, (2) PFE (filter 1) filtered data, and (3) CMN (filter 2) filtered data.

The heading of each plot lists these pertinent data: (1) date, (2) the MLS system under test (TISC), (3) type of flight pattern, (4) theodolite solution (three-station), (5) run number, (6) start time, (7) aircraft tail number and type of antenna, and (8) data collection interface used. In addition, the plots indicated by the letter "F" or "S" show whether a frame flag or system flag occurred. A frame flag indicates that a received data sample was declared illegal and an approximate value was substituted for it by the receiver. A system flag indicates that a large number of illegal data samples were received and the receiver output was invalid.

The first set of flight data is for glide slope approaches of 3°, 5°, and 7°, with some flights at centerline and right or left of centerline at about ±9° (pages A-1 to A-54). The decision point for all these data is located 1.32 nmi from the azimuth phase center. For the 7° glide slope approach, near right 9°, the azimuth angle from the elevation site varies from -16.5° to -10.3° for ranges from 1.3 to 7.7 nmi. This indicates that for split-site arrangements, an elevation antenna should have a wide enough beam, approximately ±20°, to cover the azimuth coverage region of ±10°. The 3° glide slope 9° azimuth angle and the 5° glide slope 9° azimuth angle approaches have some extraneous data points, probably due to tracker tape errors, which should be ignored. The 7° glide slope centerline approach and 9° right (1332 and 1111 hours) show large tracking errors (outliers) which were not removed during processing. In appendix C, pages C-1 and C-2 show the error specification limits for the various flight data, which are within the tolerances specified.

The second set of flight data (pages A-55 to A-84) is for radials (level runs) along centerline at 2,000 feet and 5,000 feet and two runs at ±9° azimuth. For the

2,000-foot runs, the azimuth coverage extends up to 15°, which is about 1.5 nmi from the azimuth phase center.

The elevation coverage for the same runs extends up to 10.67°, which is about 3 nmi from the azimuth phase center. For the 5,000-foot run, the azimuth coverage is from 3.5 nmi and the elevation coverage is from 5.5 nmi. The data for the 2,000-foot centerline and 9° angle runs are valid only up to about 2.0 nmi due to a loss of tracker data. For the coverages indicated, the data are within specifications as indicated by the accuracy plots on pages C-3 and C-4.

The third set of flight data (pages A-85 to A-126) is for partial orbits at about 7 nmi and elevation angles of approximately 1.9°, 2.7°, 4.8°, and 7.5°. Data for the 2,200-foot orbit (approximately 2.7°) exhibit some tracker errors which are to be ignored. The 3,700-foot orbit exhibits a temporary (less than 2-seconds duration) out-of-tolerance condition for the azimuth signal (A-105). The same orbit exhibits a large MLS elevation (A-106) spike at about -4°, which was probably due to the airborne interface unit or tape error, but not to receiver error, as a flag does not occur at this time. These extraneous errors should probably be removed in future processing as they are magnified when processed through the PFE and CMN filters. All of the azimuth data exhibit a near out-of-tolerance condition for the CMN-filtered data near centerline. This can be compared to the static data for azimuth crosscuts (appendix B, pages B-6 to B-10) which exhibit the same effects. It is assumed this condition is part of the antenna design rather than fresnel diffraction due to the narrow azimuth monitor pole. The monitor pole sits about 75 feet away at 3° and is a narrow 2-inch-diameter pole with a 3-inch by 5-inch horn. For the orbits, the elevation data are plotted relative to the azimuth site. Although the azimuth angles from the azimuth unit vary ±10°, the azimuth angle from the elevation site varies from -11.6° to +10.7°. All of the orbit data is within accuracy specification limits which are shown on plots C-5 and C-6.

The filter used to extract CMN data from the raw error data was a digital band-pass filter which was necessarily initialized to the first sample of data. This filter should have had no bias output, and the mean value of an increasingly large number of samples is asymptotic to zero. However, immediately upon initialization, the sample size was small, and this, combined with the response time of the filter, yielded an initial bias. Upon inspection of the data in appendix A, it is seen that the first few samples of data produced by the CMN filter contain the bias factor and should be ignored (especially where flags occur) when making comparisons to specification values.

STATIC DATA.

The static data allows an estimate of system bias and instrument noise to be made. The bias measured in the static data would correspond to the PFE at that point in space, while the "noise" (standard deviation points) measured is the hardware and instrument noise, which is one component of the CMN estimated by flight tests. The azimuth data (appendix B, pages B-5 through B-10) consists of a centerline pole-cut at a range of 626 feet and five crosscuts at

pole heights of 45, 50, 55, 60, and 65 feet, and azimuth angles from +12° to -12°. The centerline error plot shows coverage to extend down to the 20-foot pole height, which is about 1° above the horizon. The five crosscut plots show coverage out to ±10° and show the distribution of errors consistent over the various elevation angles. All of the plots are relative to the azimuth phase center.

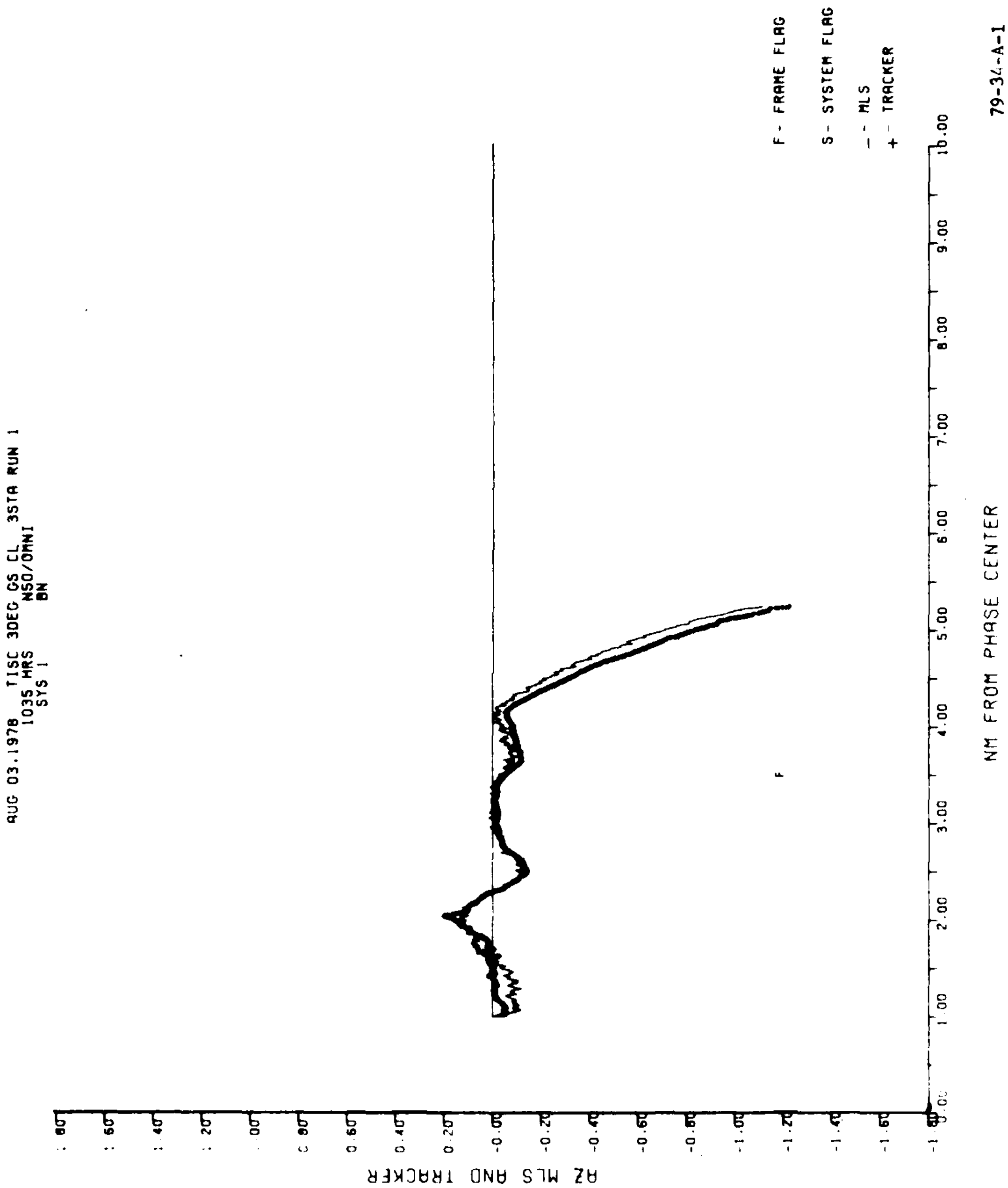
The elevation data in appendix B (pages B-1 through B-4) consist of a boresight plot and three crosscut plots at pole heights of 20, 50, and 68 feet. The crosscut plots for azimuth angles relative to the elevation unit are from +9° to -9°. The elevation beam (boresight plot) was electronically adjusted to give good coverage in the lower glide slope region (relative to the azimuth phase center), which in this case was about 1.8° to 5.0°. The crosscut plot shows a slight azimuth bias in mean error but is within specification. The 2-sigma errors are generally around ±0.01° and were too small to plot.

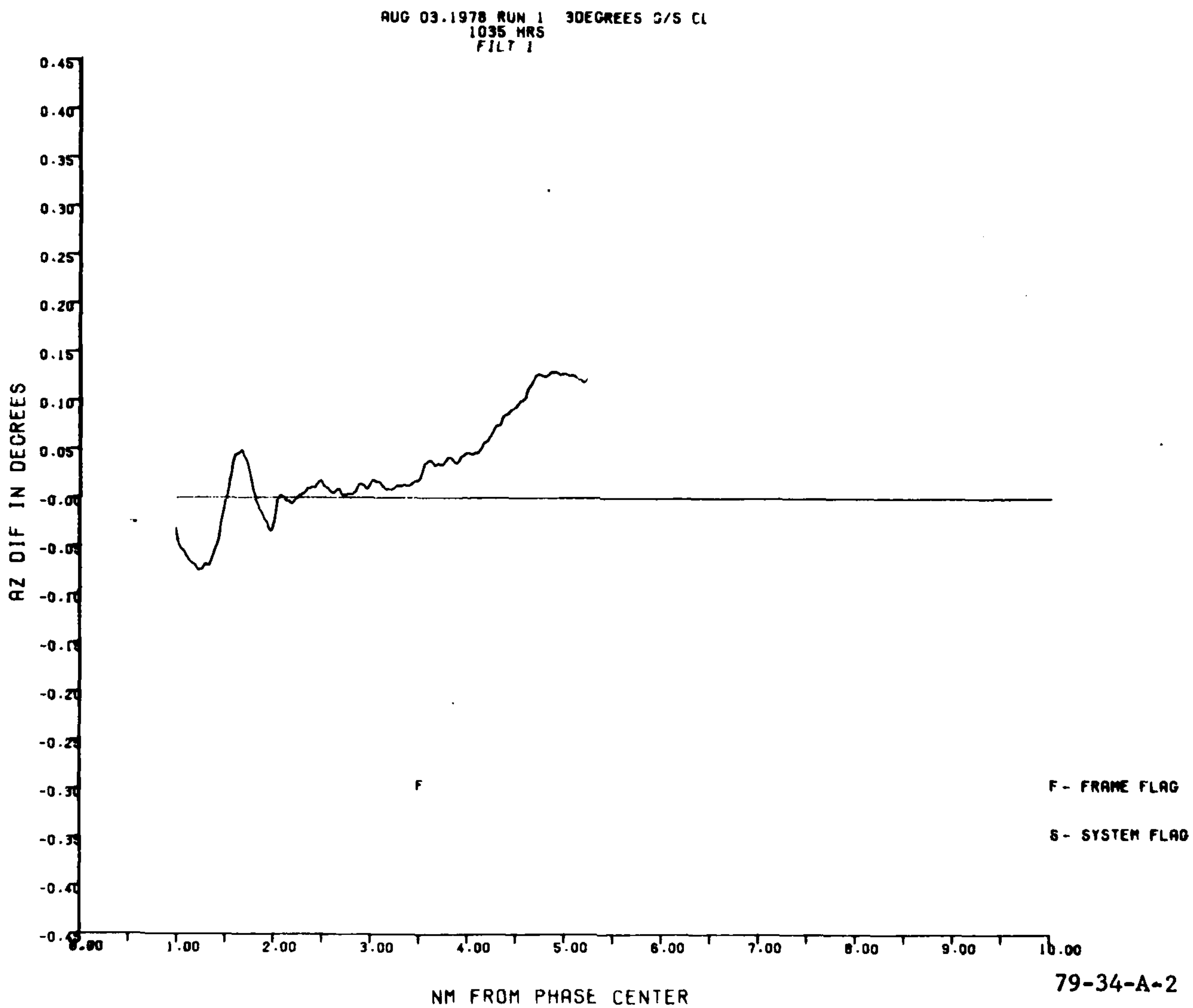
CONCLUSION

The data displayed in this report have been compared with specifications written by the Federal Aviation Administration (FAA) for these particular systems. Also, the data were obtained under controlled conditions without severe multipath. Based on the results of the tests conducted, it is concluded that the guidance signals from the Texas Instruments Small Community Microwave Landing System (SCAMLS) were within contractual specification limits.

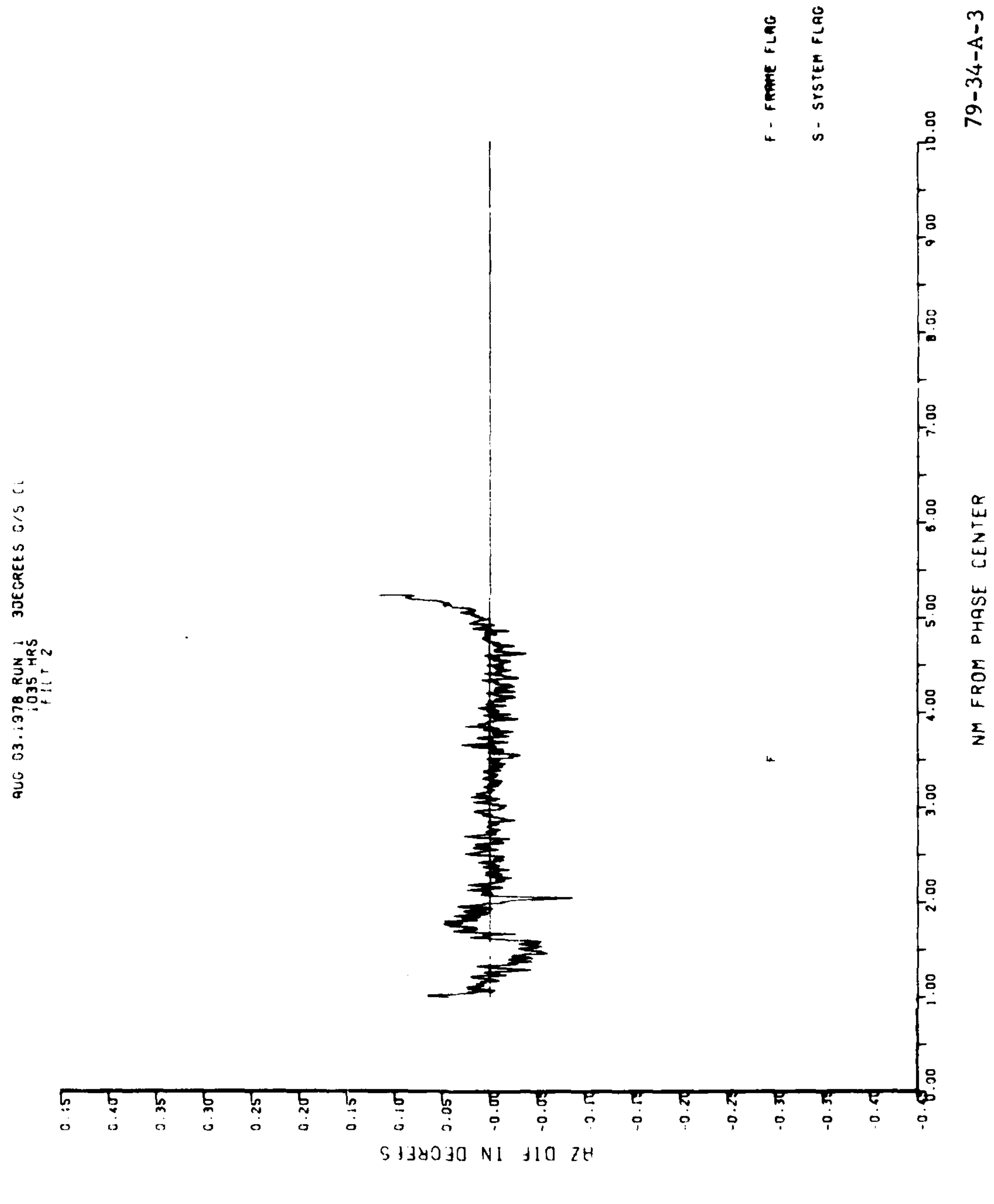
APPENDIX A

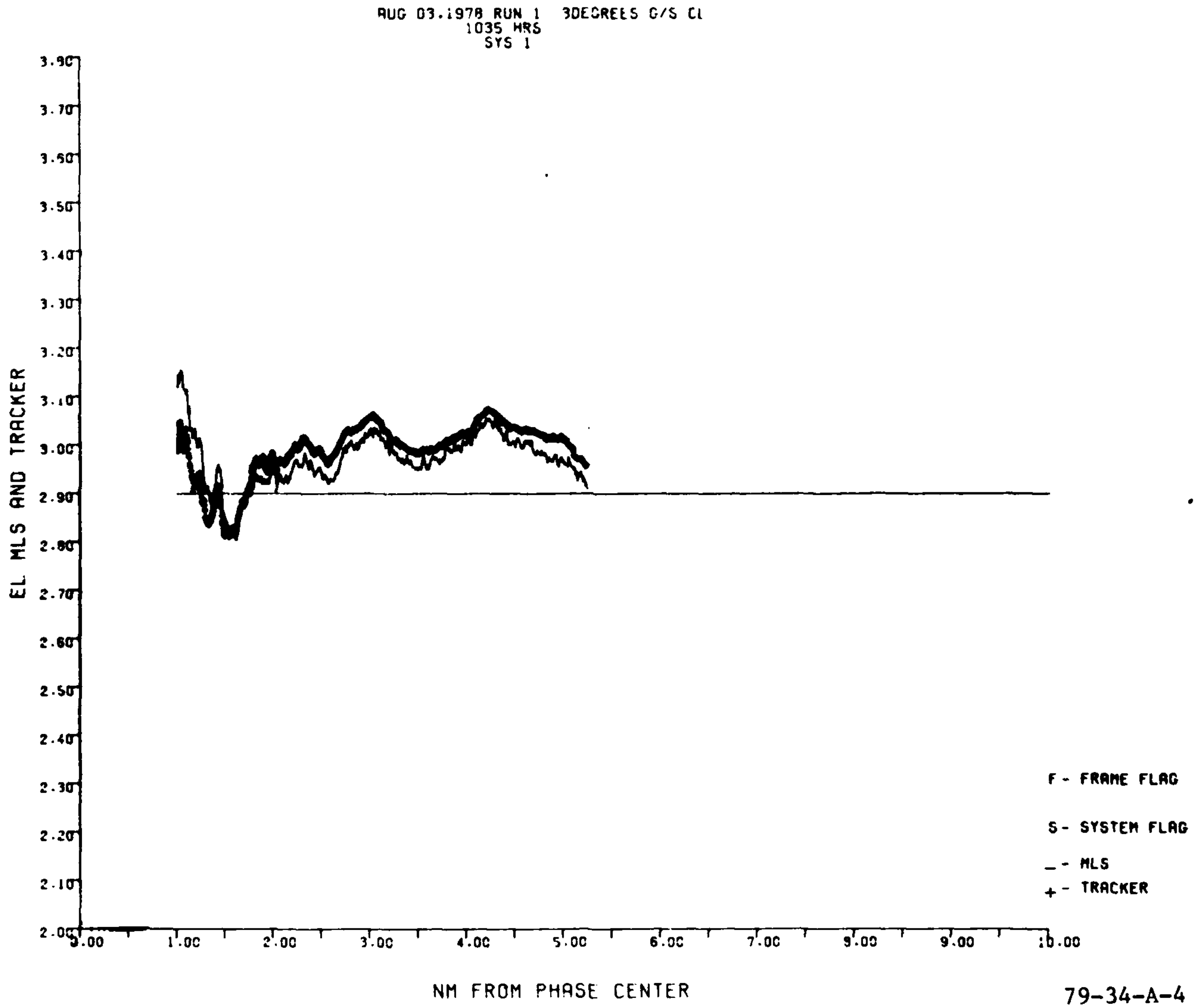
FLIGHT DATA


AUG 03.1978 TISC 3DEG GS CL 3STA RUN 1
1035 HRS NSO/OMNI
SYS 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
— - MLS
+ - TRACKER
NM FROM PHASE CENTER
AZ MLS AND TRACKER
79-34-A-1


AUG 03.1978 RUN 1 3DEGREES G/S CL
1035 HRS
FILT 1
AZ DIF IN DEGREES
NM FROM PHASE CENTER
F- FRAME FLAG
S- SYSTEM FLAG

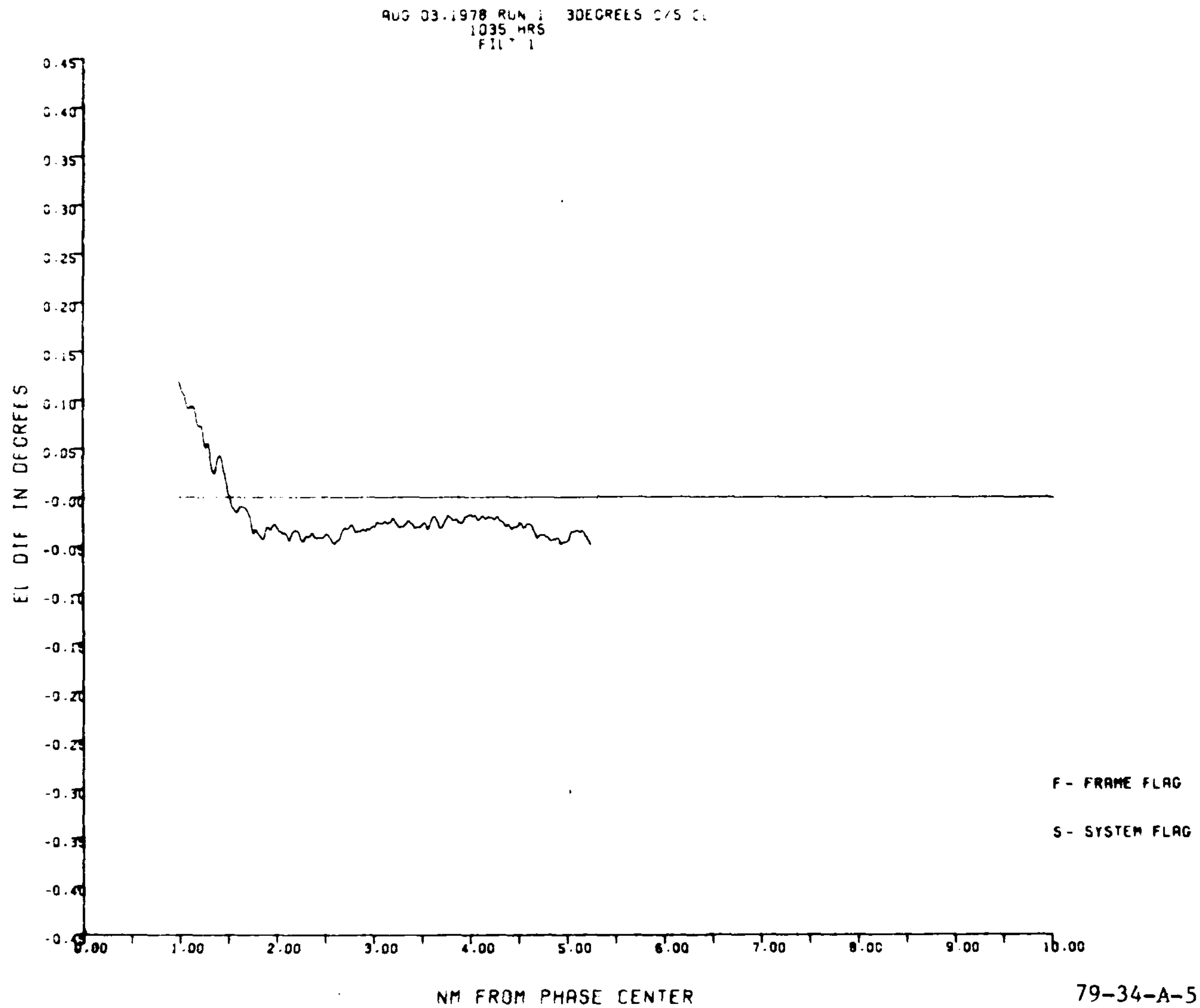
79-34-A-2


AUG 03.1978 RUN 1 3DEGREES G/S CL
1035 HRS
FILT 2
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM PHASE CENTER
AZ DIF IN DEGREES
79-34-A-3

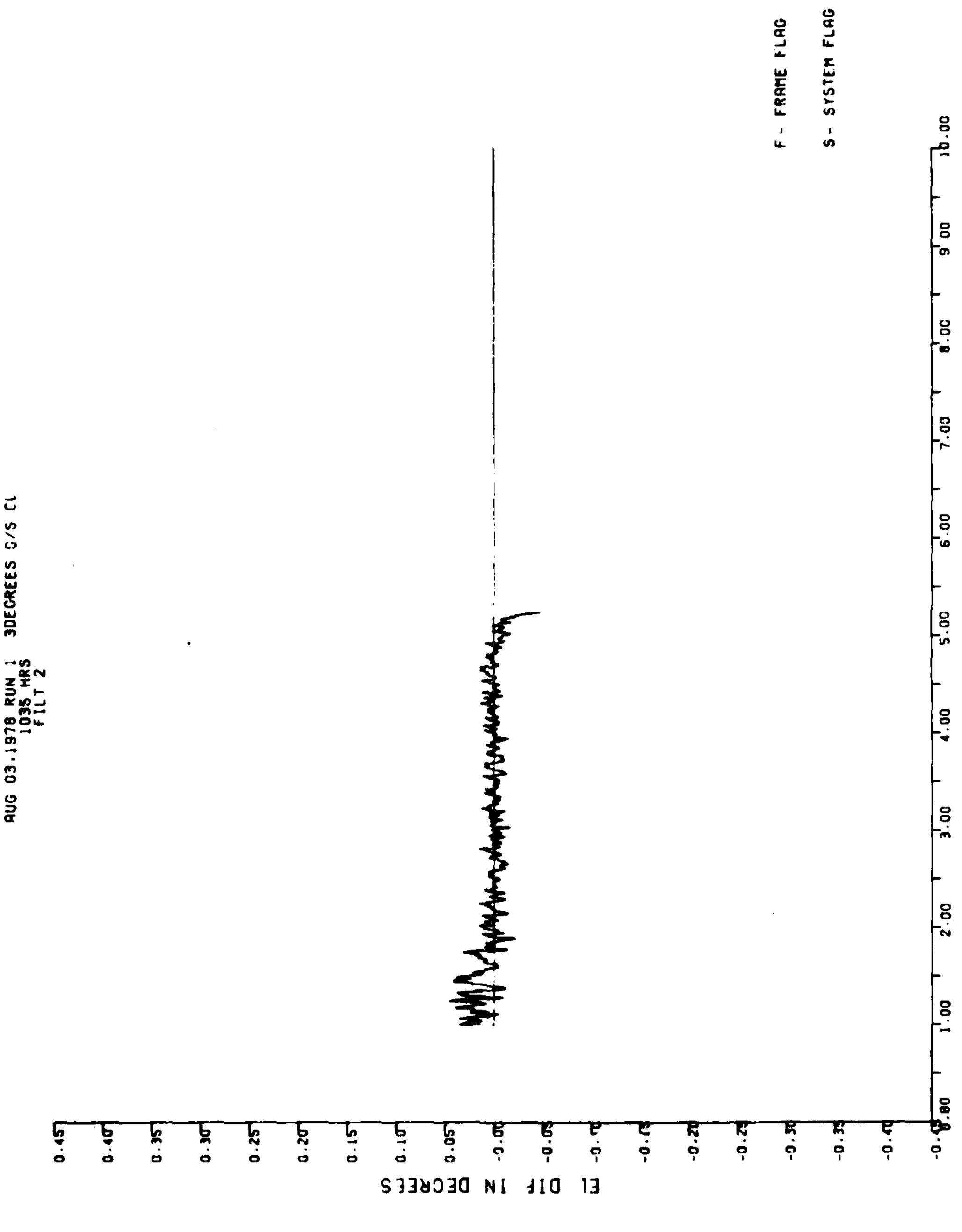


AUG 03.1978 RUN 1 3DEGREES G/S CL
1035 HRS
SYS 1
EL MLS AND TRACKER
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
_ - MLS
+ - TRACKER

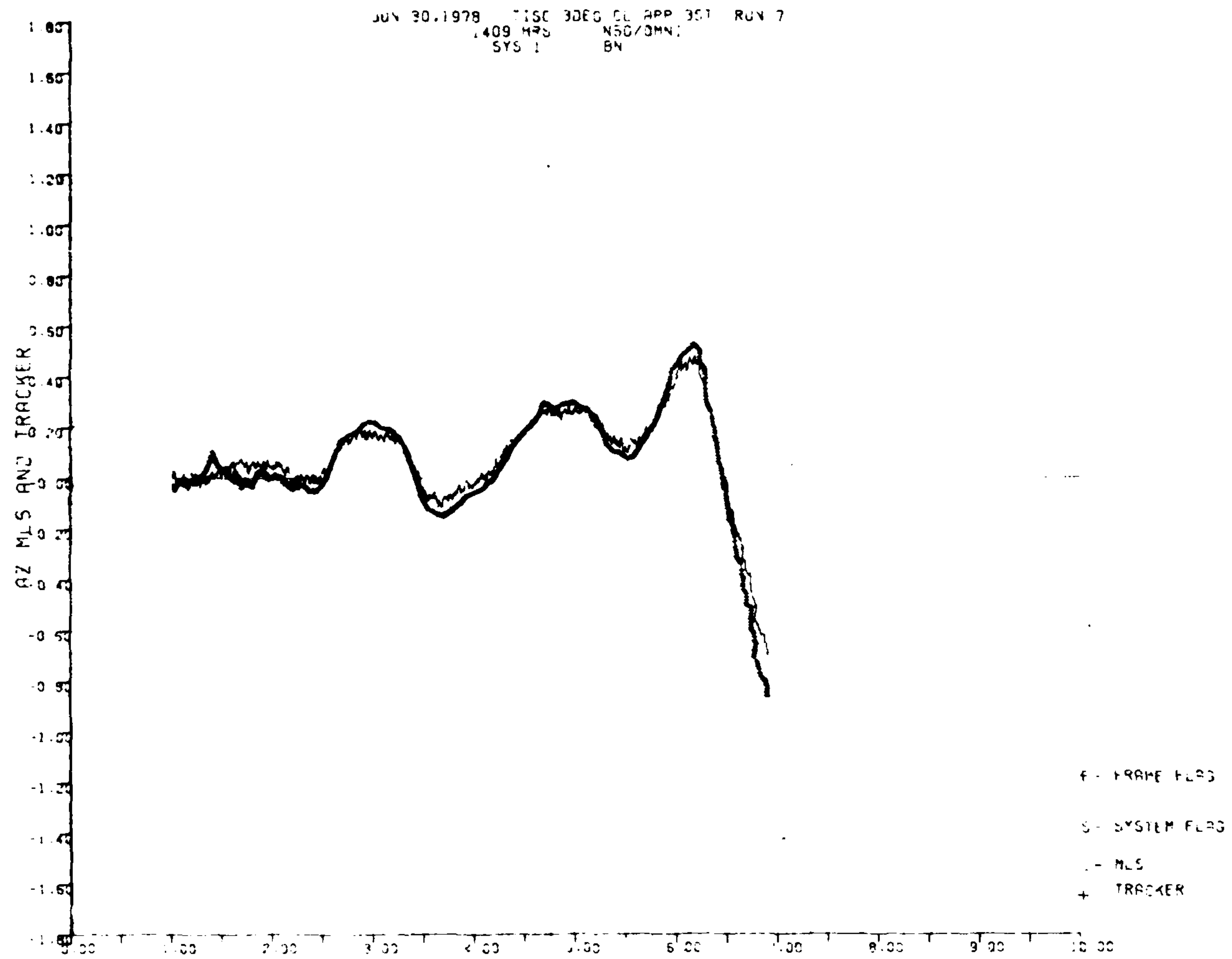
79-34-A-4


AUG 03.1978 RUN 1 3DEGREES C/S CL
1035 HRS
FIL 1
EL DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

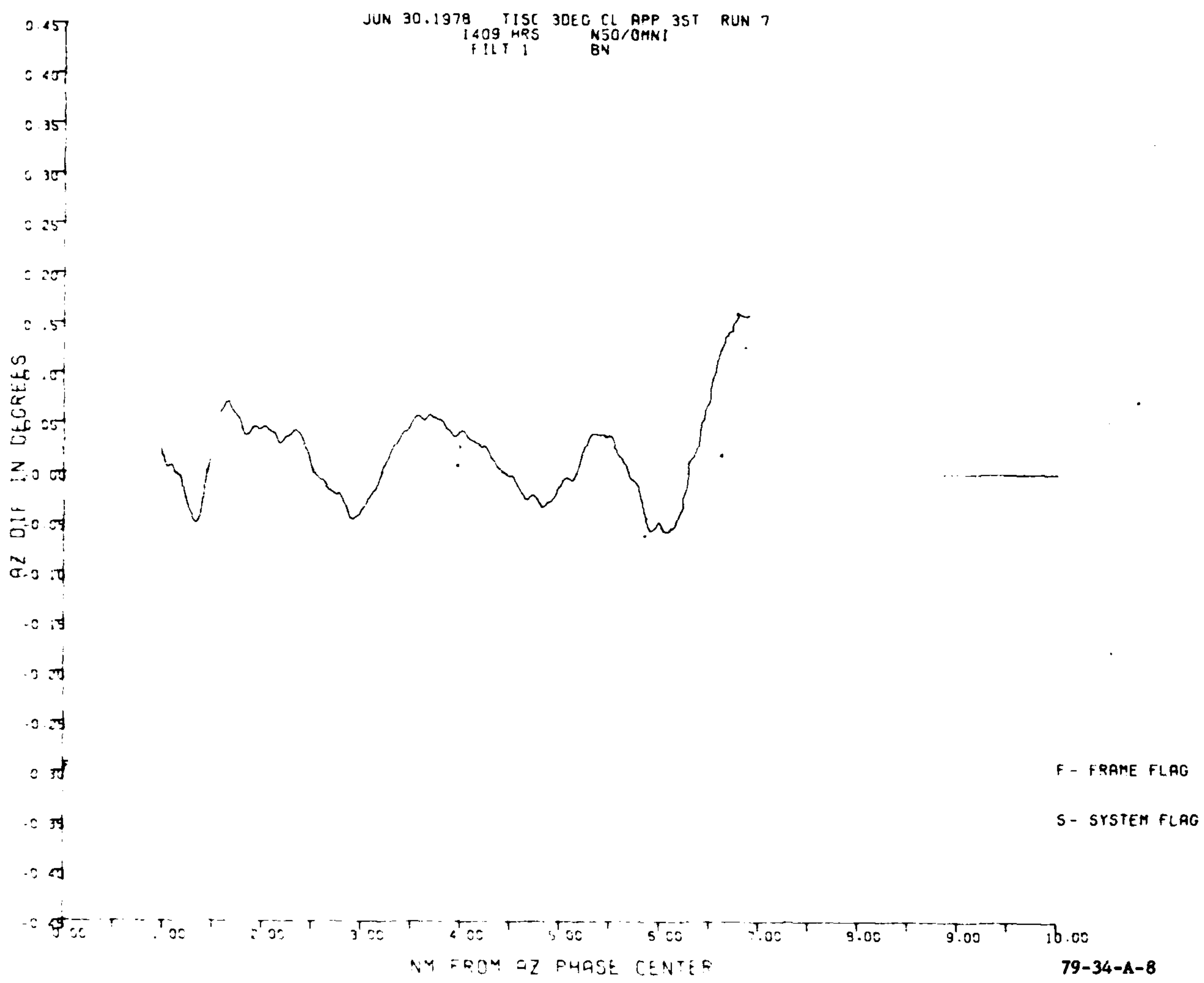
79-34-A-5

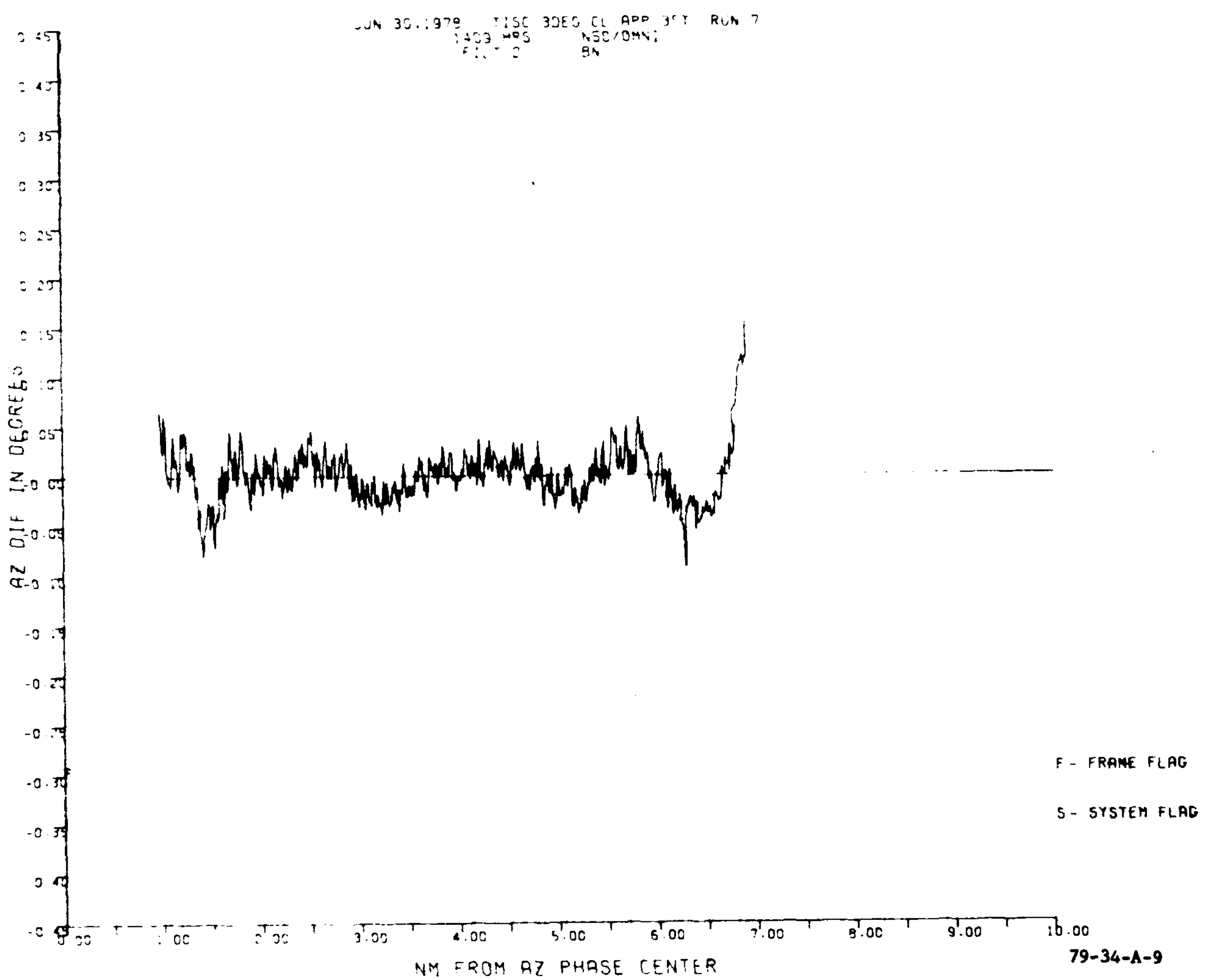

AUG 03.1978 RUN 1 3DEGREES G/S CL
1035 HRS
FILT 2
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM PHASE CENTER
EL DIF IN DEGREES
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05

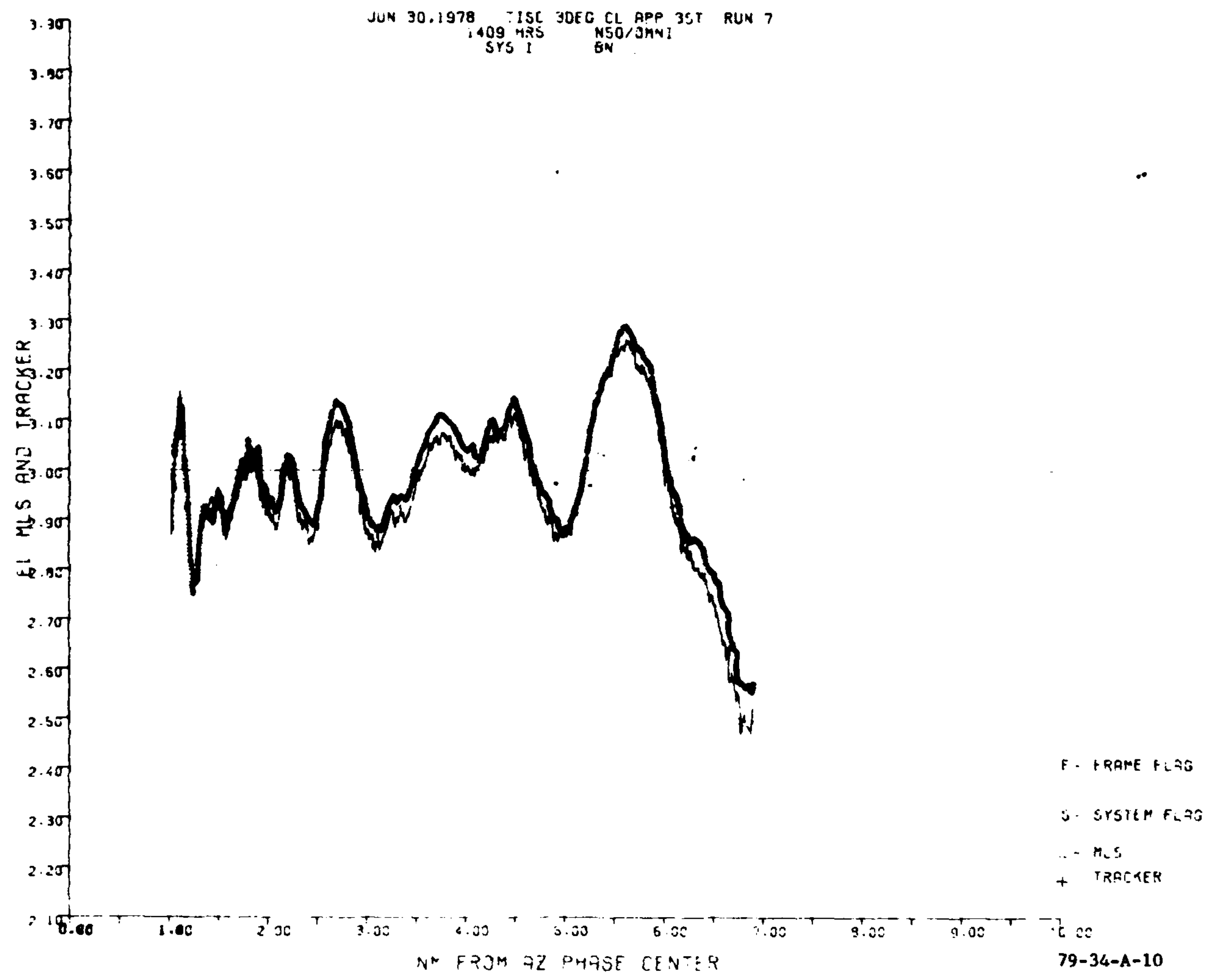
79-34-A-6


JUN 30,1978 TISC 3DEG CL APP 3ST RUN 7
1409 HRS N50/OMNI
SYS 1 BN
AZ MLS AND TRACKER
1.80
1.60
1.40
0.60
0.40
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
- MLS
+ TRACKER

79-34-A-7

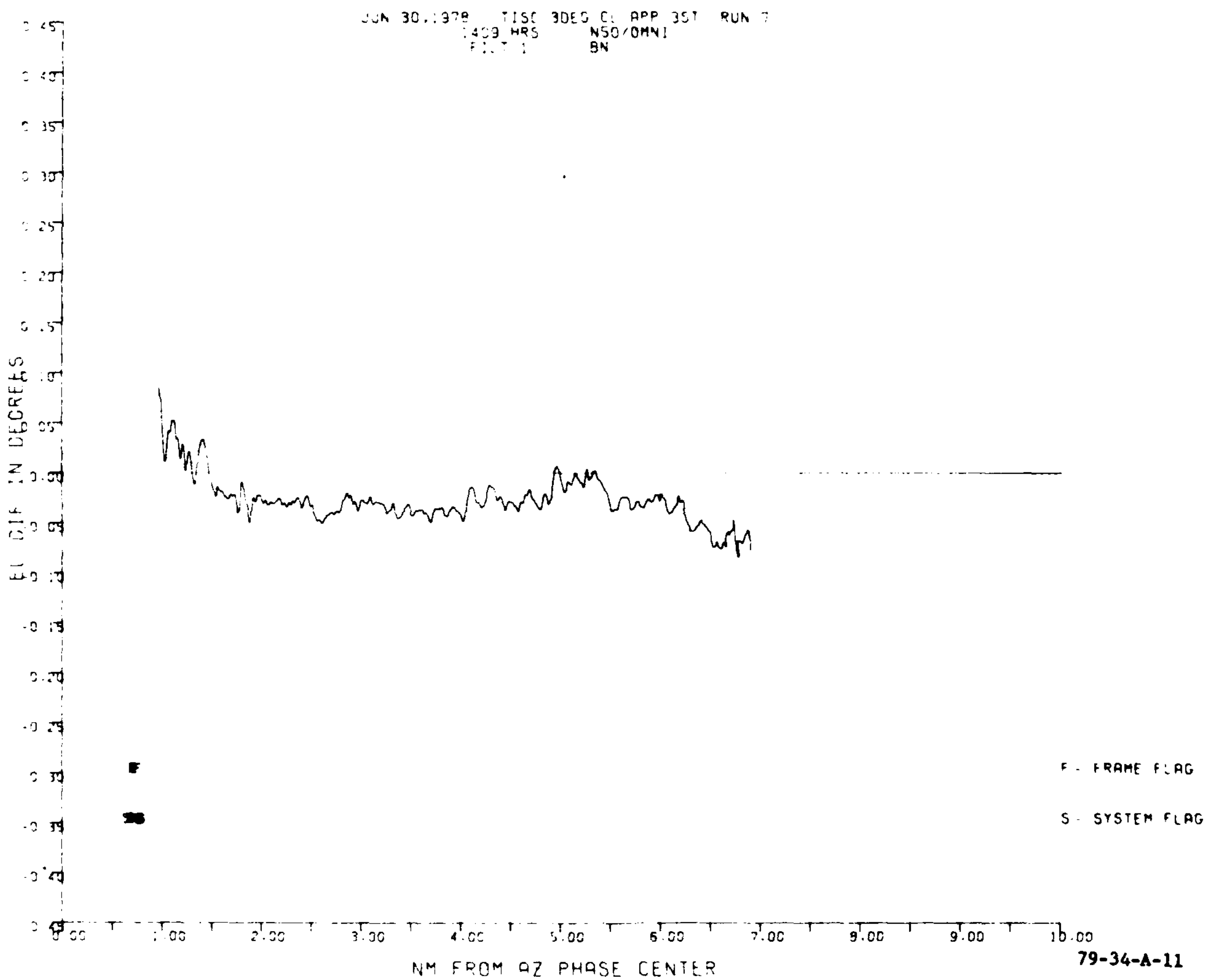

JUN 30.1978 TISC 3DEG CL APP 3ST RUN 7
1409 HRS N50/OMNI
FILT 1 BN
AZ DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-8


RUN 7
AZ DIF IN DEGREES
NM FROM AZ PHASE CENTER
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-9



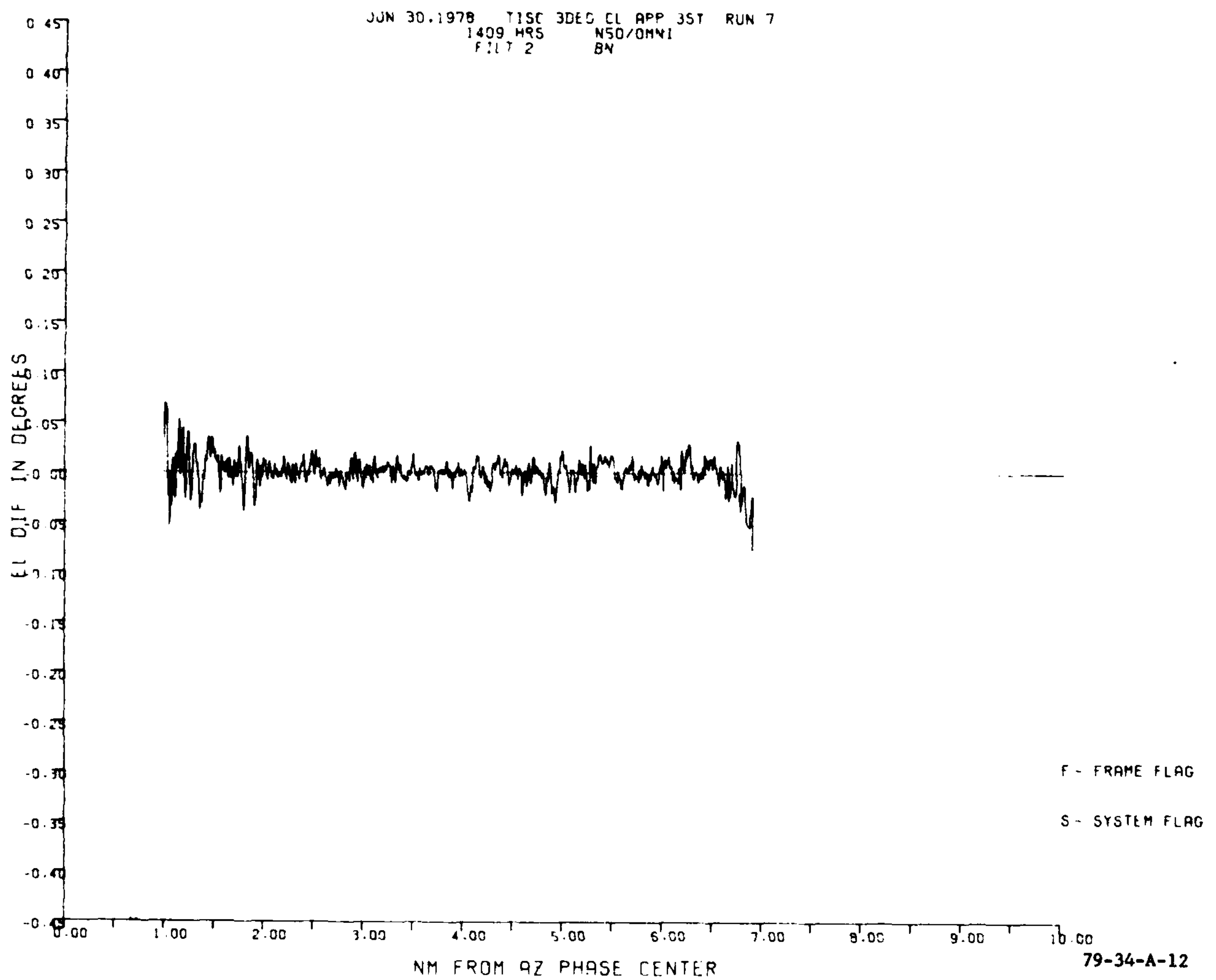
JUN 30,1978 TISC 3DEG CL APP 3ST RUN 7
1409 HRS N50/OMNI
SYS I BN
EL MLS AND TRACKER
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
. - MLS
+ TRACKER

79-34-A-10

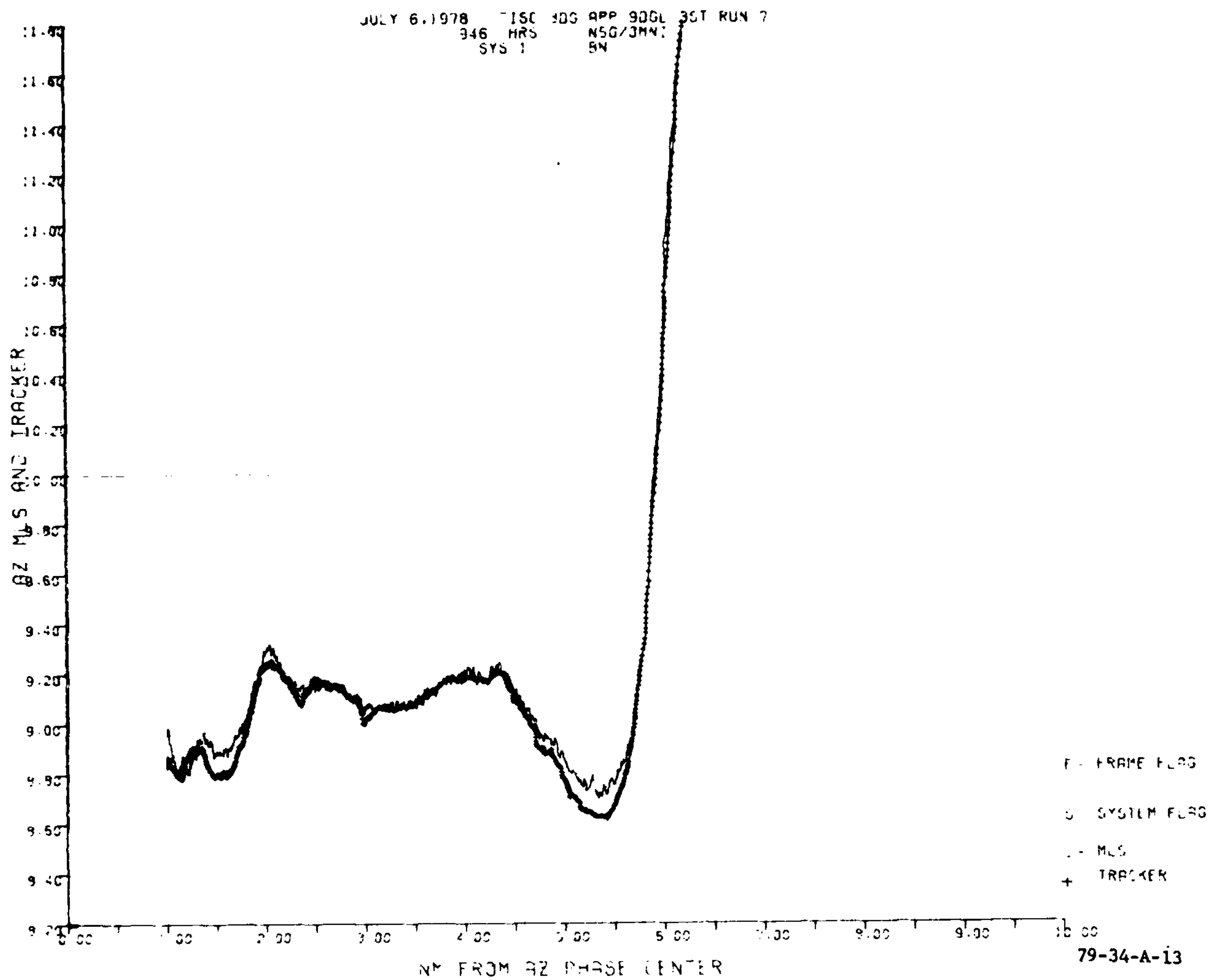


RUN 7
N50/OMNI
BN
EL DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

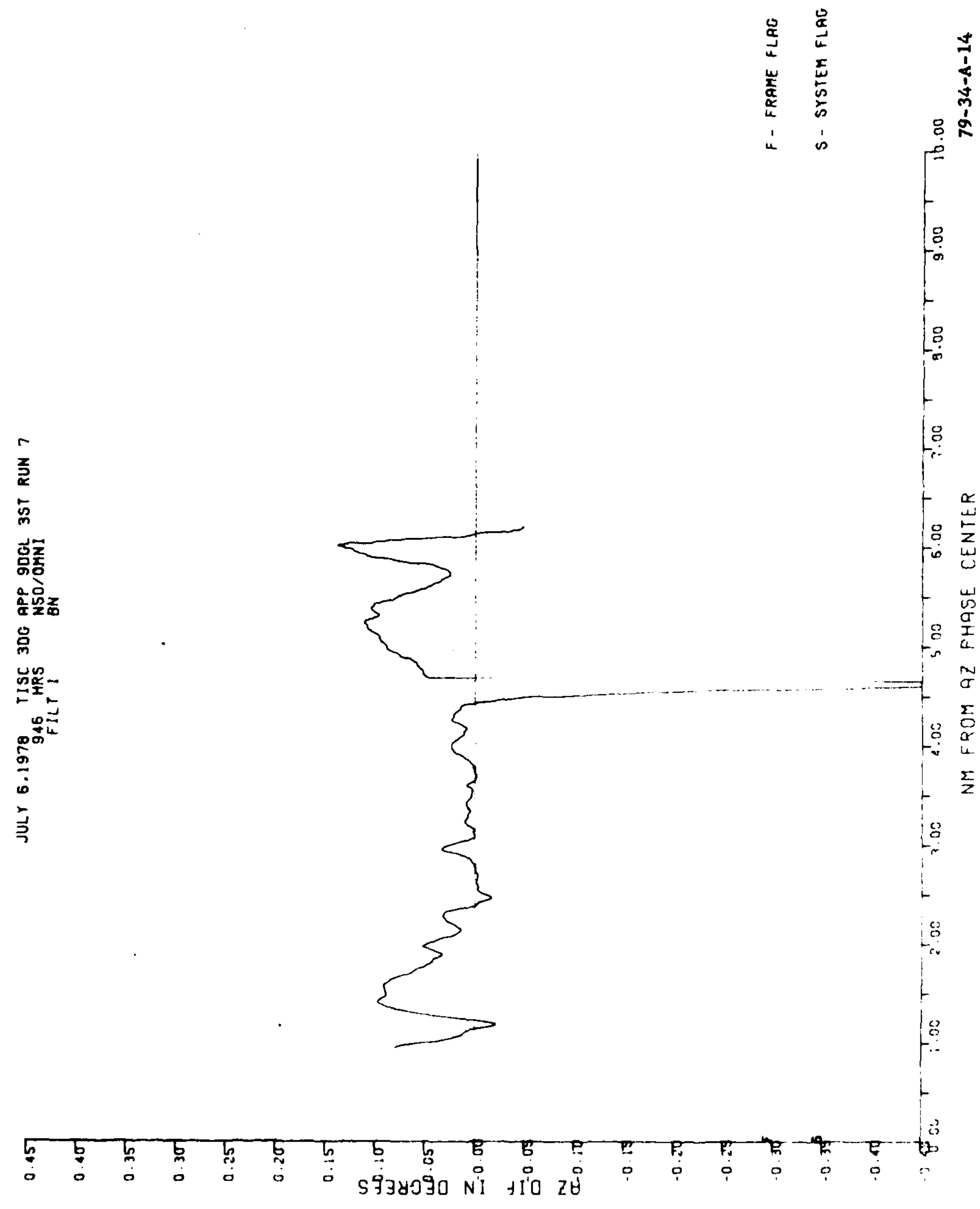
79-34-A-11

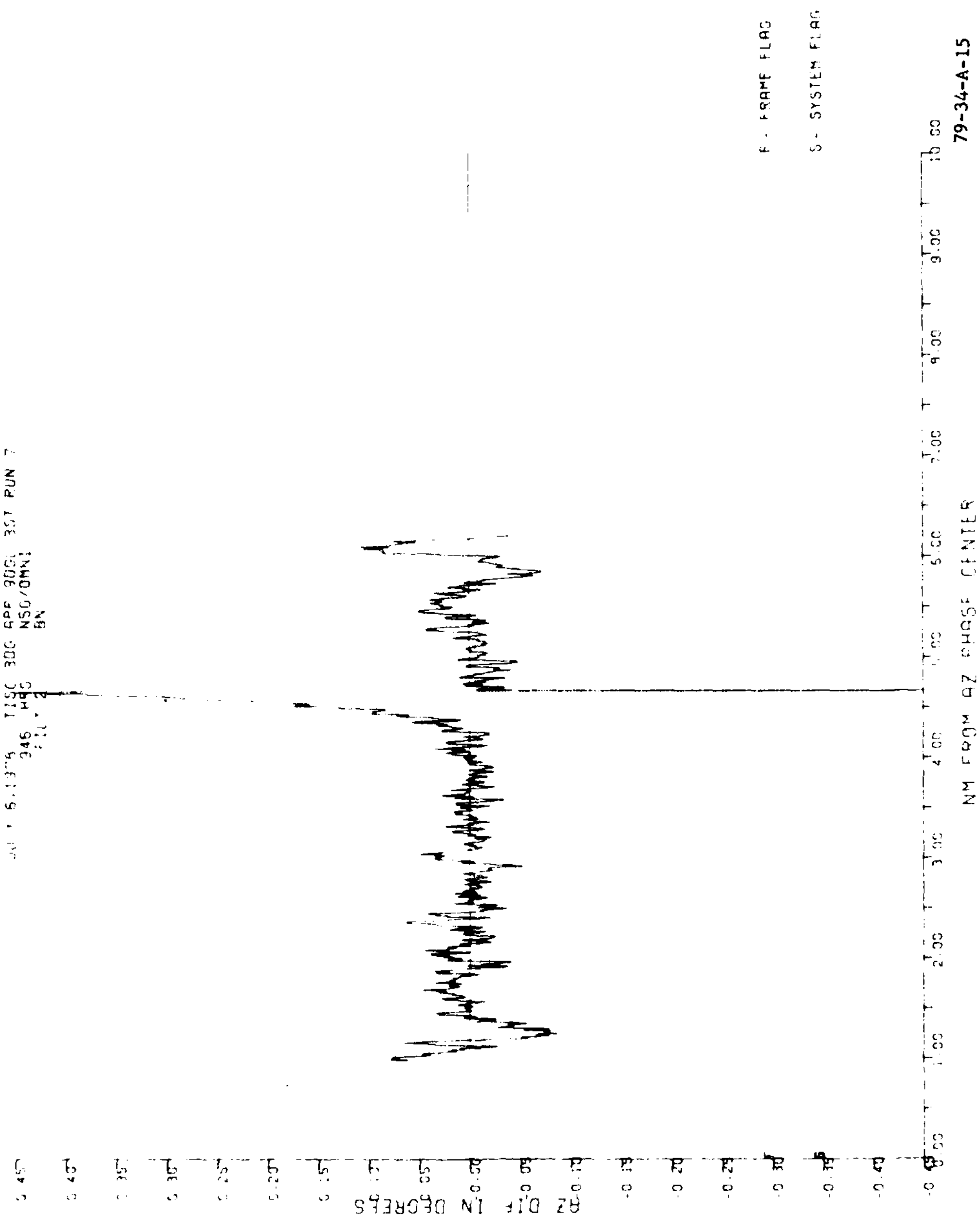

JUN 30,1978 TISC 3DEG EL APP 3ST RUN 7
1409 HRS N50/OMNI
FILT 2 BN
EL DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

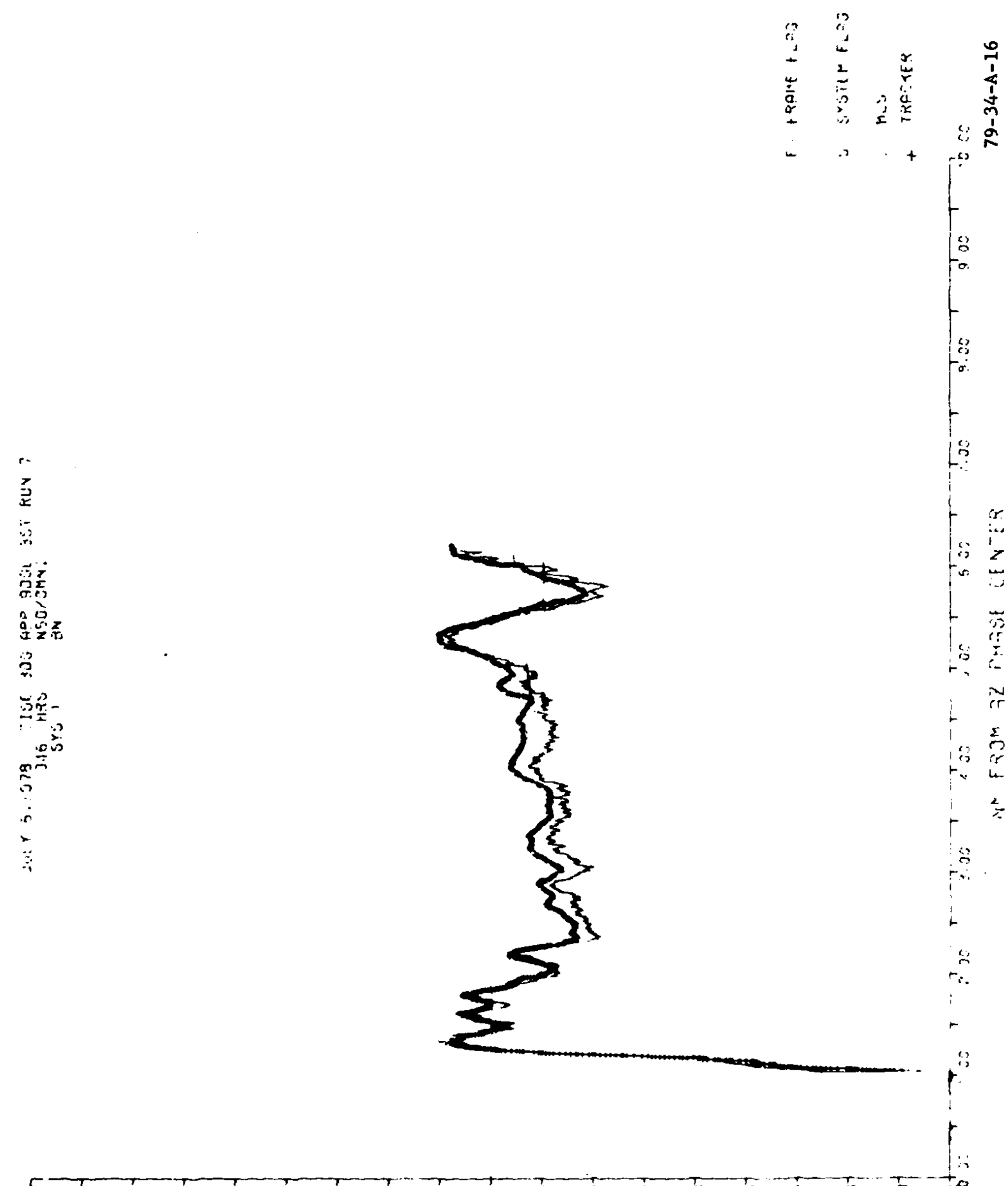
79-34-A-12

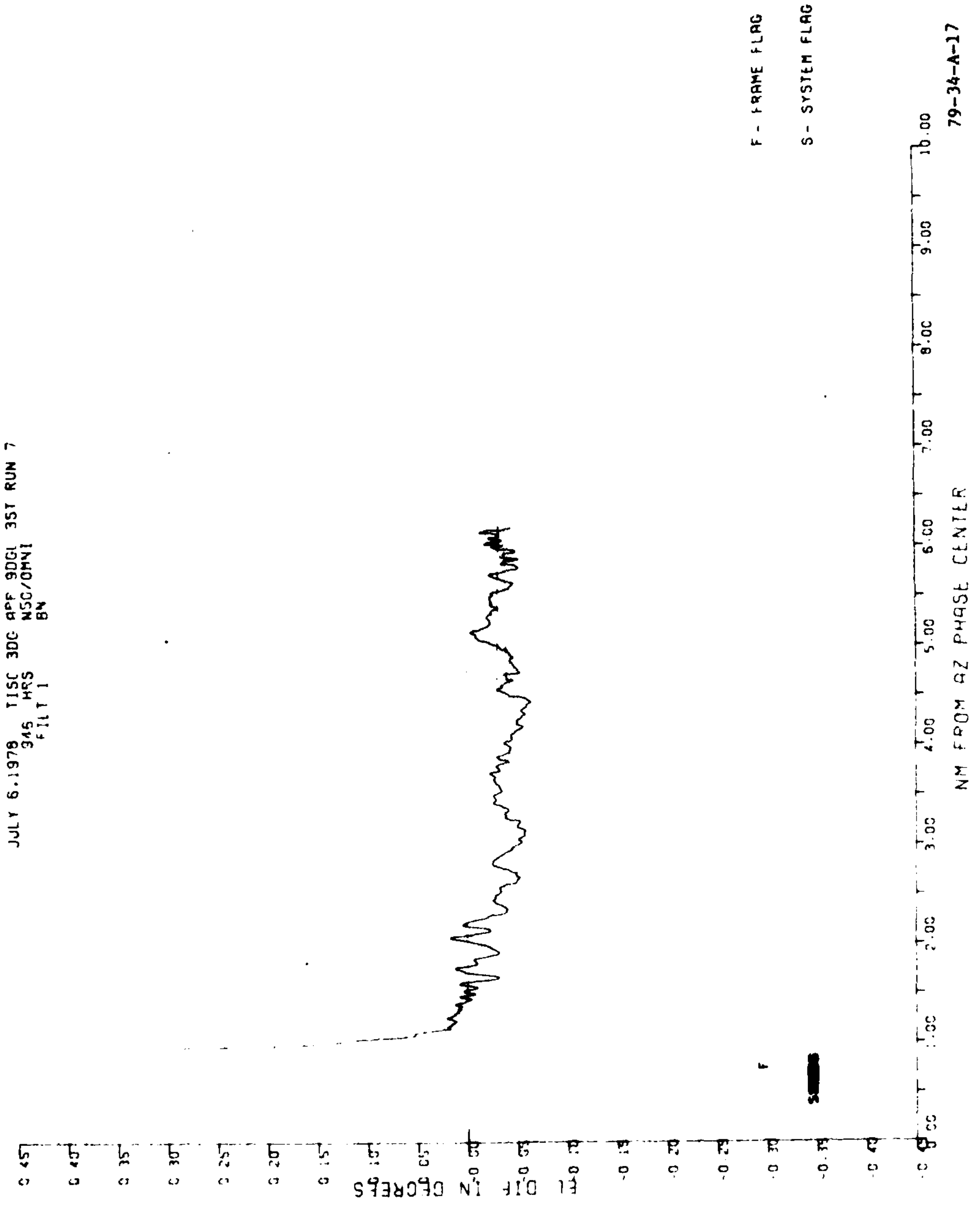

JULY 6,1978 TISC 3DG APP 9DGL 3ST RUN 7
946 HRS NSG/3MNI
SYS 1 BN
AZ MLS AND TRACKER
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
- MLS
+ TRACKER

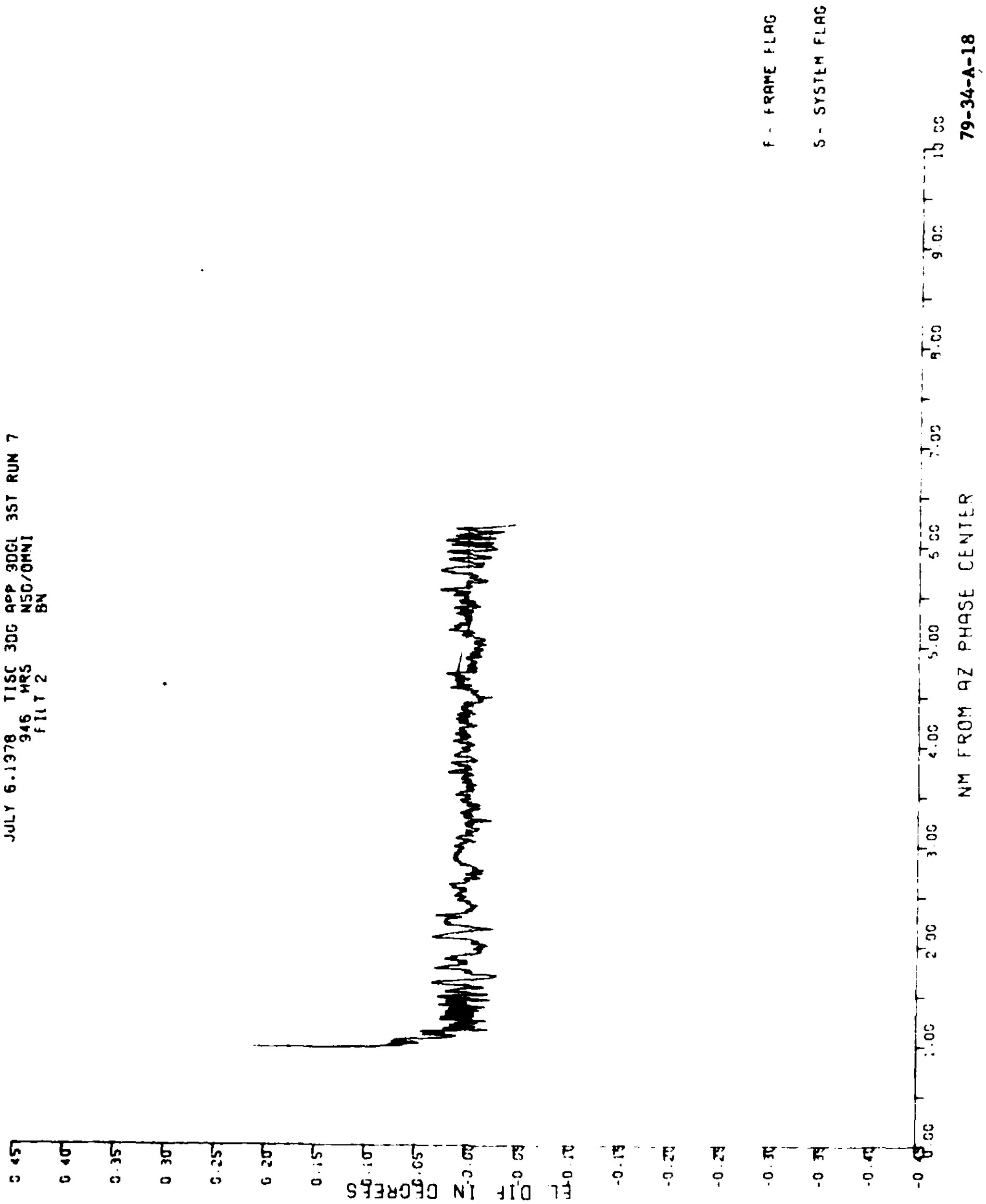
79-34-A-13


JULY 6,1978 TISC 3DG APP 9DGL 3ST RUN 7
946 HRS NSO/OMNI
FILT I BN
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM AZ PHASE CENTER
AZ DIF IN DEGREES
79-34-A-14

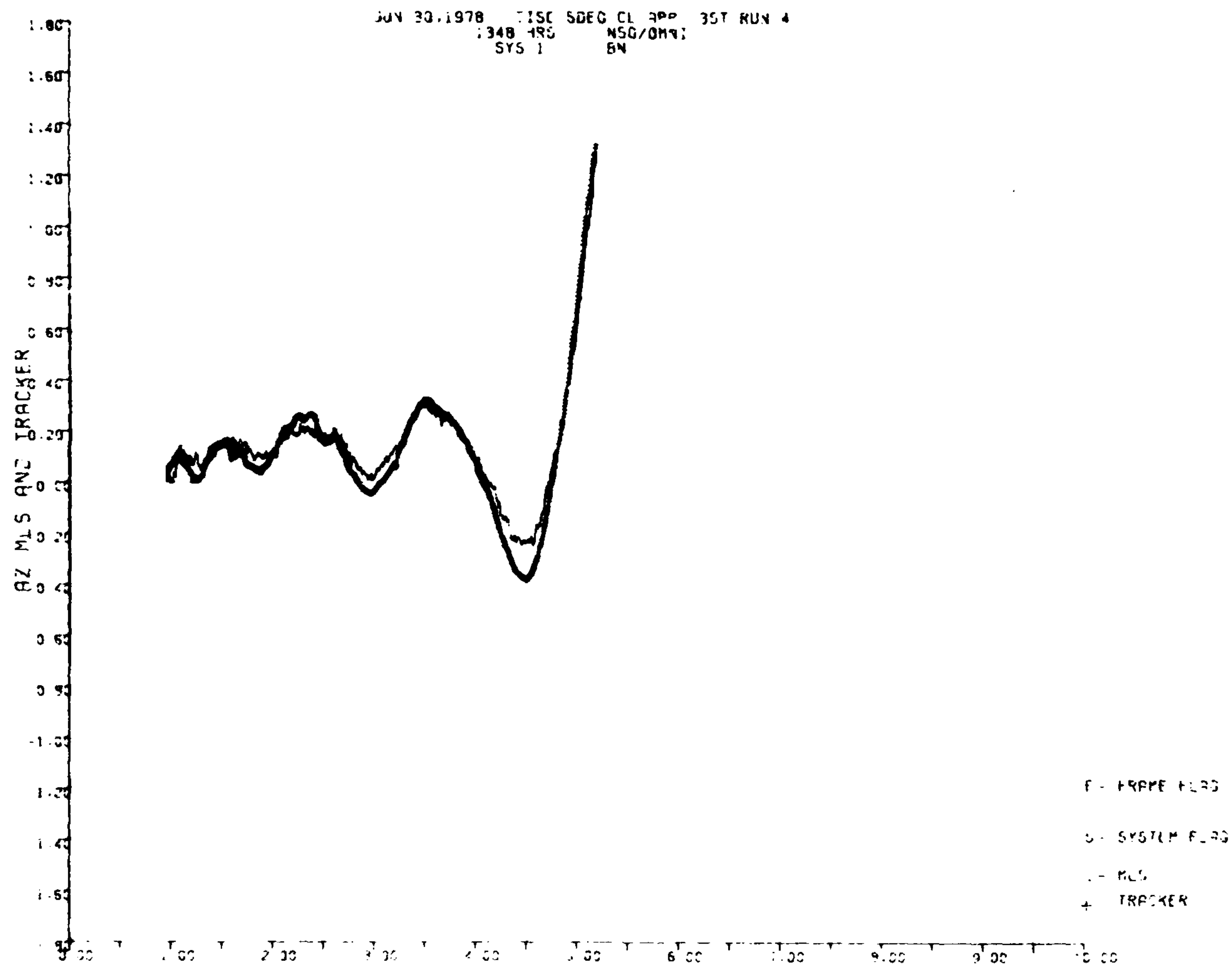

F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-15
NM FROM AZ PHASE CENTER
AZ DIF IN DEGREES


79-34-A-16

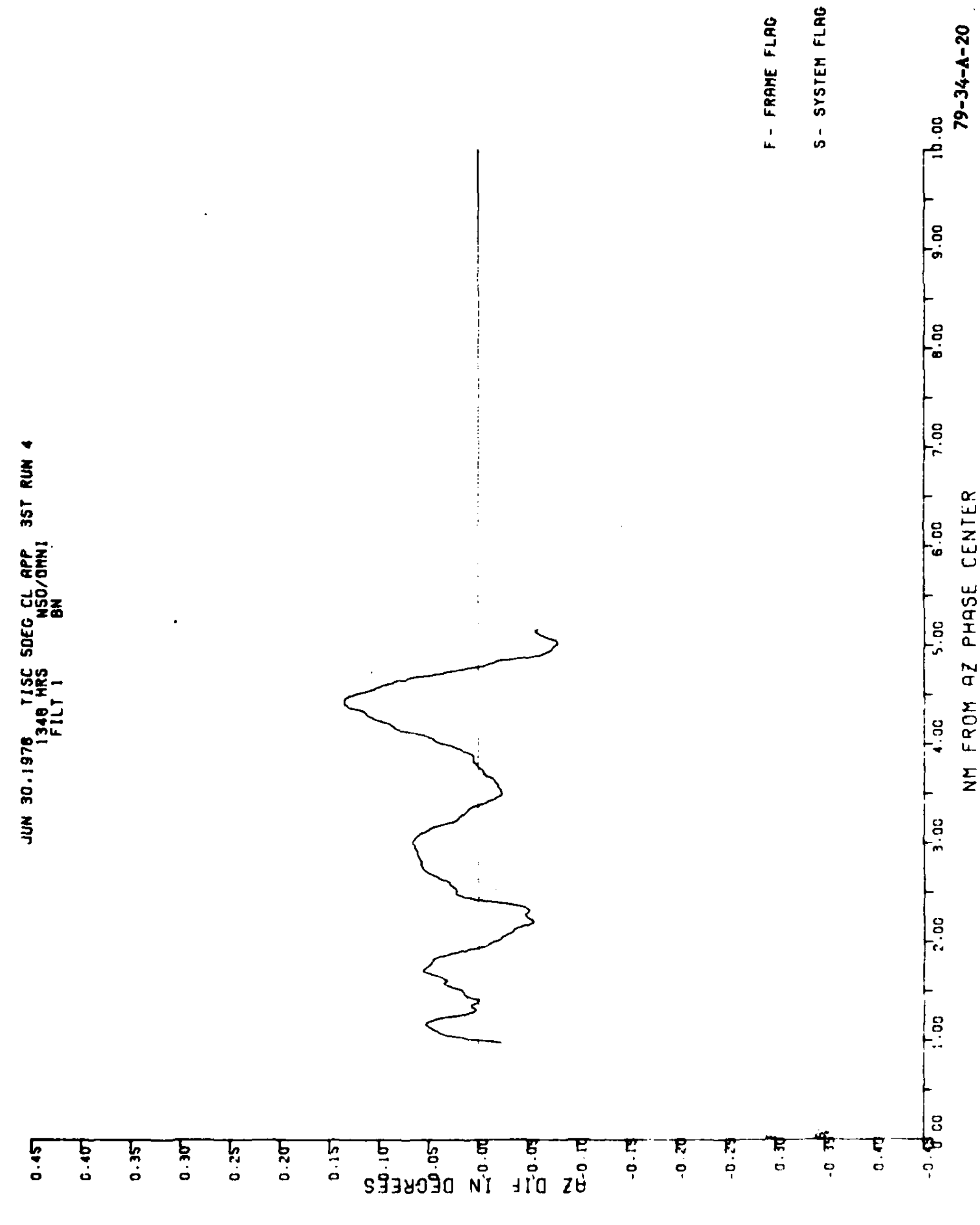

JULY 6,1978 TISC 3DG APF 9DGL 35T RUN 7
345 HRS NSC/OMNI
FILT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
EL DIF IN DEGREES
NM FROM AZ PHASE CENTER
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
79-34-A-17


JULY 6,1978 TISC 3DG APP 3DGL 3ST RUN 7
946 HRS N5D/OMNI
FILT 2 BN
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM AZ PHASE CENTER
EL DIF IN DEGREES

79-34-A-18

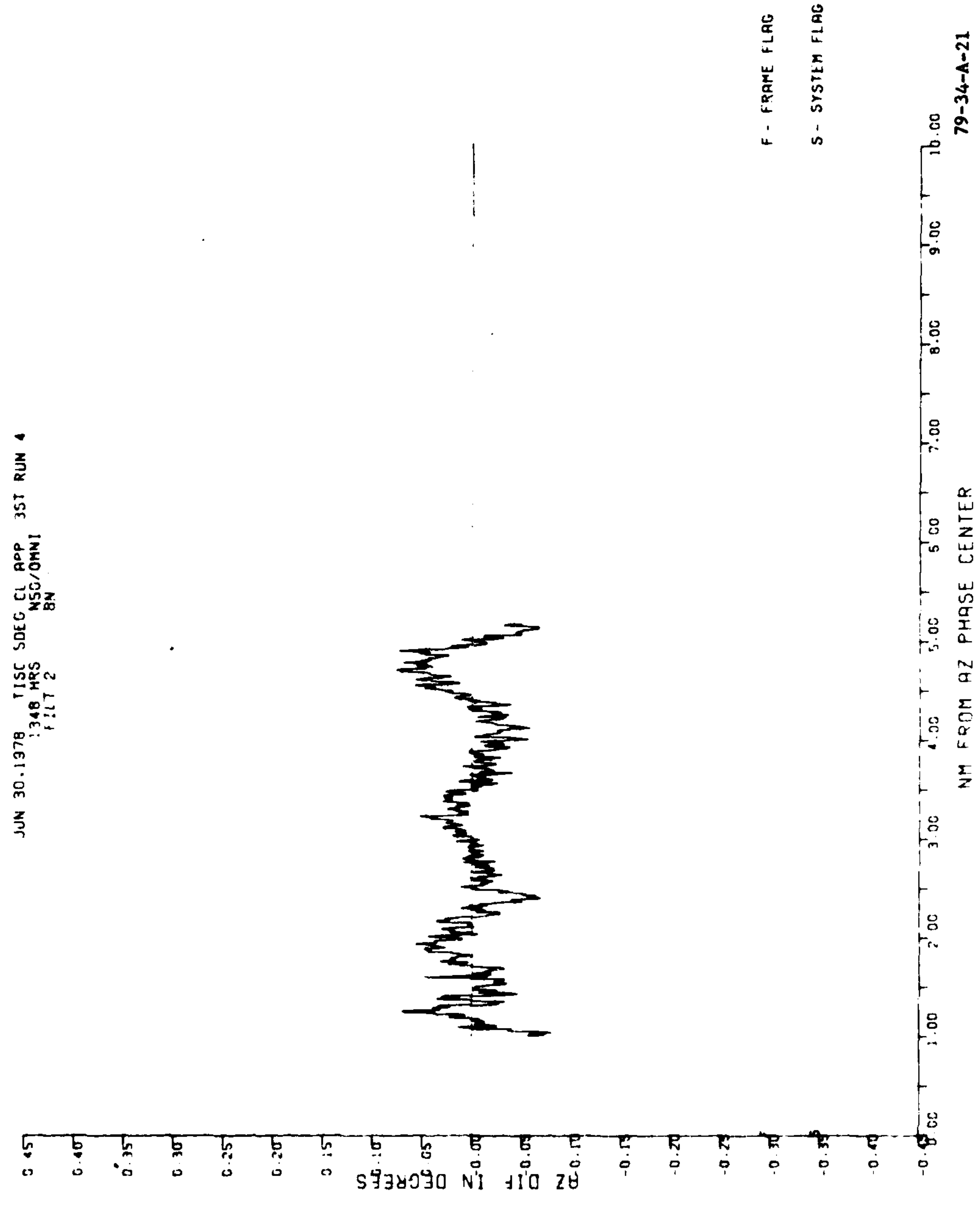

SDEG CL APP
RUN 4
NSG/OMNI
SYS 1
BN
AZ MLS AND TRACKER
FROM AZ PHASE CENTER
FRAME FLAG
SYSTEM FLAG
MLS
TRACKER

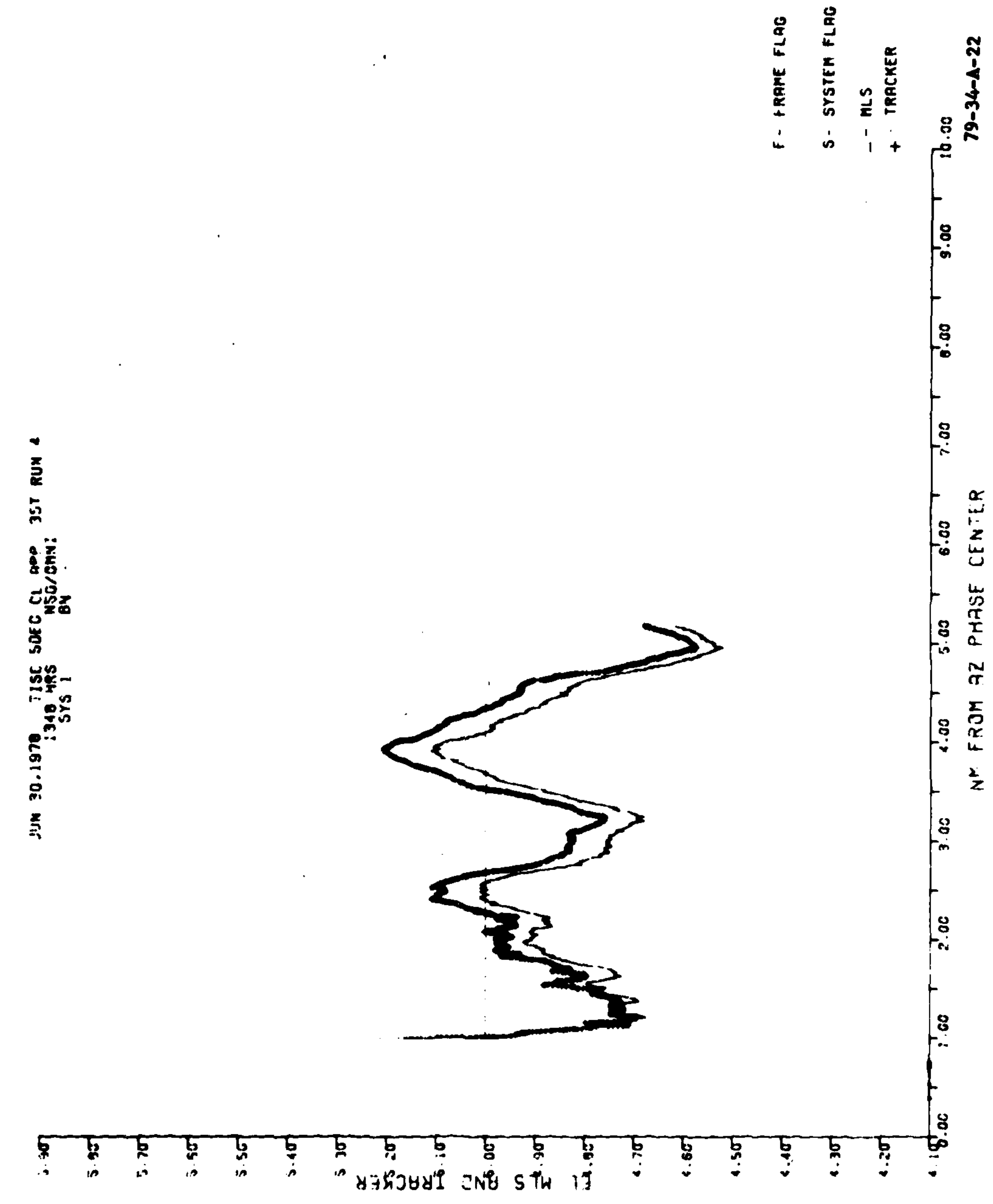
79-34-A-19

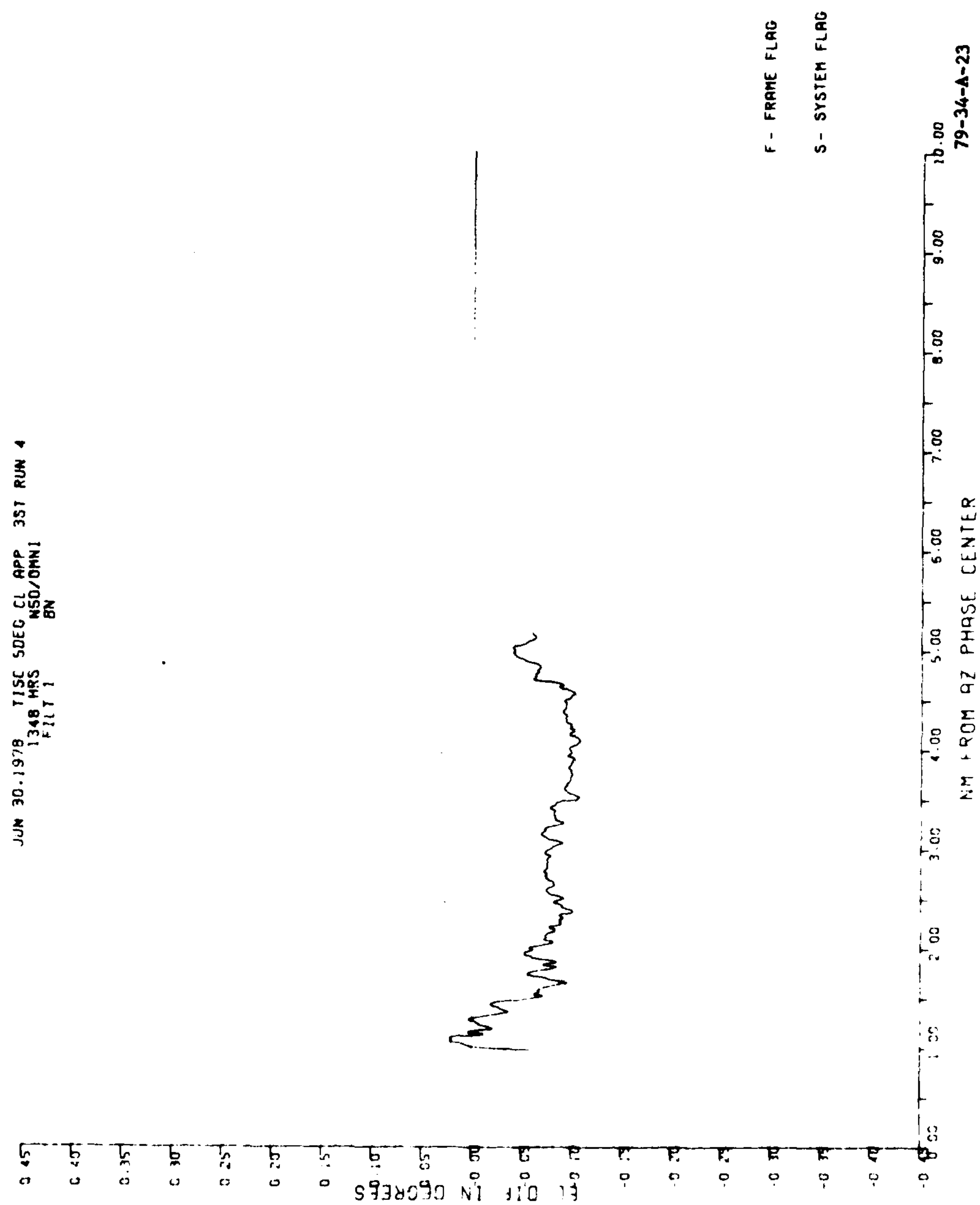


JUN 30,1978 TISC 5DEG CL APP 3ST RUN 4
1348 HRS NSO/OMNI
FILT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
AZ DIF IN DEGREES
NM FROM AZ PHASE CENTER
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00

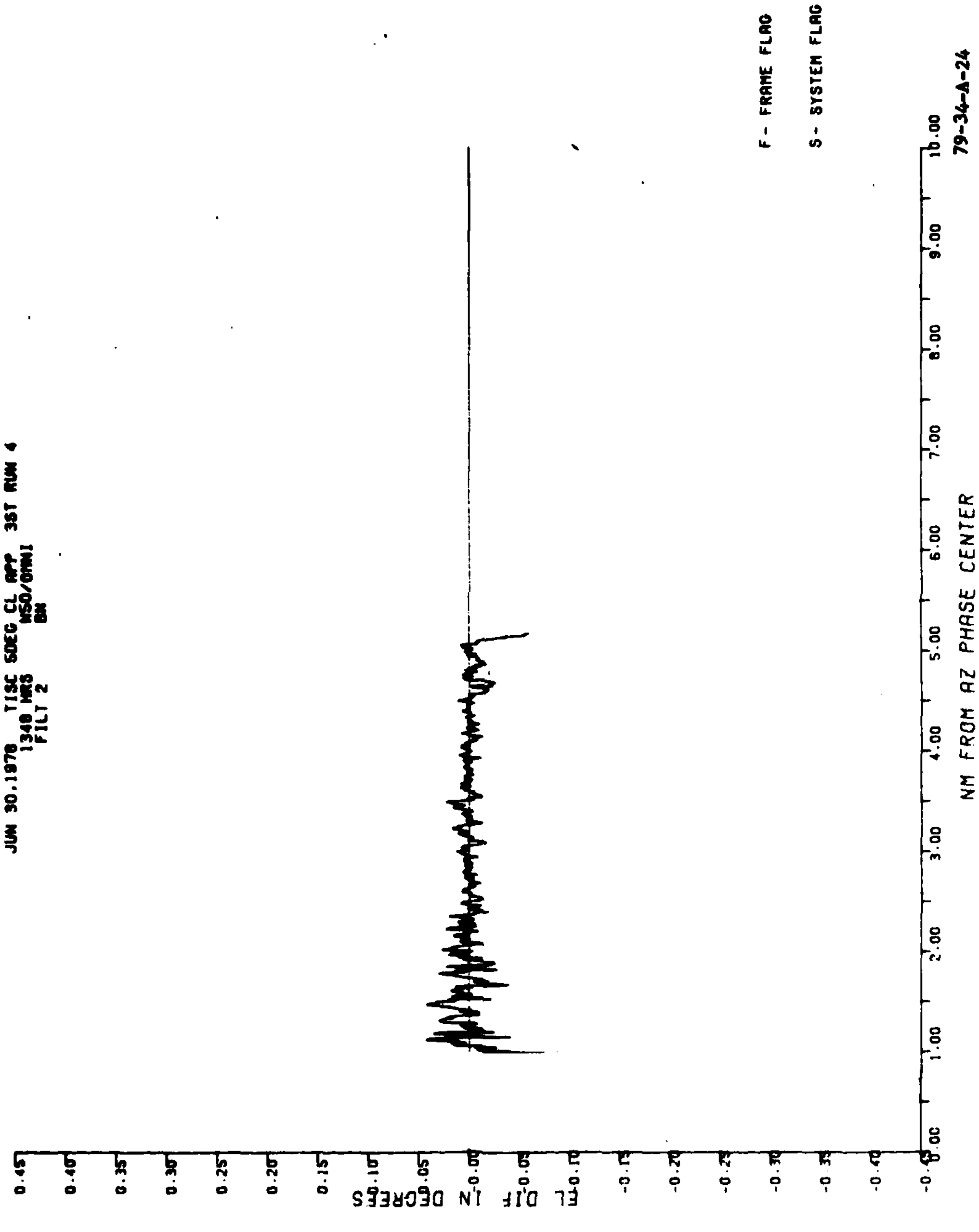
79-34-A-20

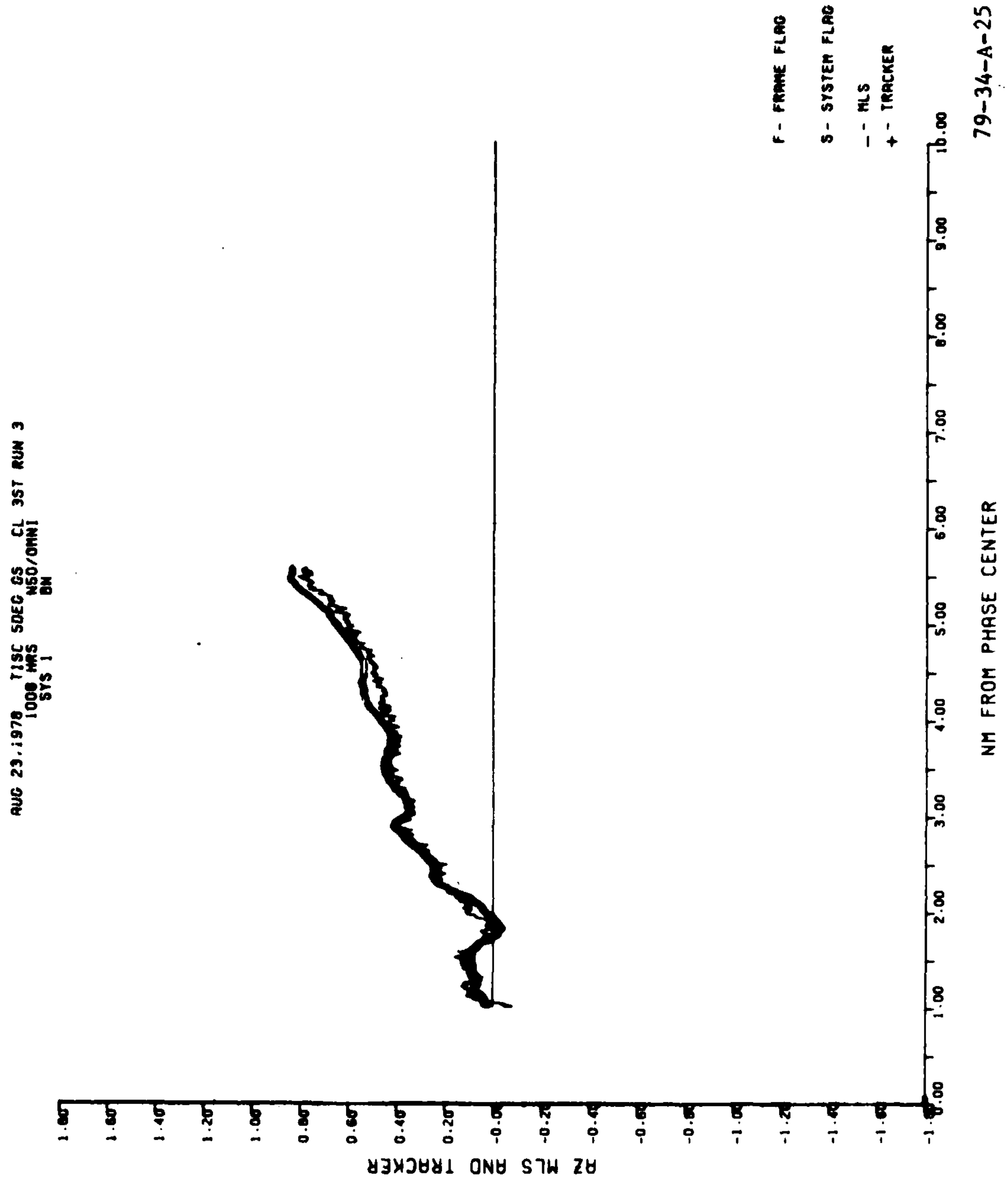

JUN 30.1978 TISC 5DEG CL APP 3ST RUN 4
1348 HRS NSG/OMNI
FILT 2 8N
F - FRAME FLAG
S - SYSTEM FLAG
AZ DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
NM FROM AZ PHASE CENTER
79-34-A-21

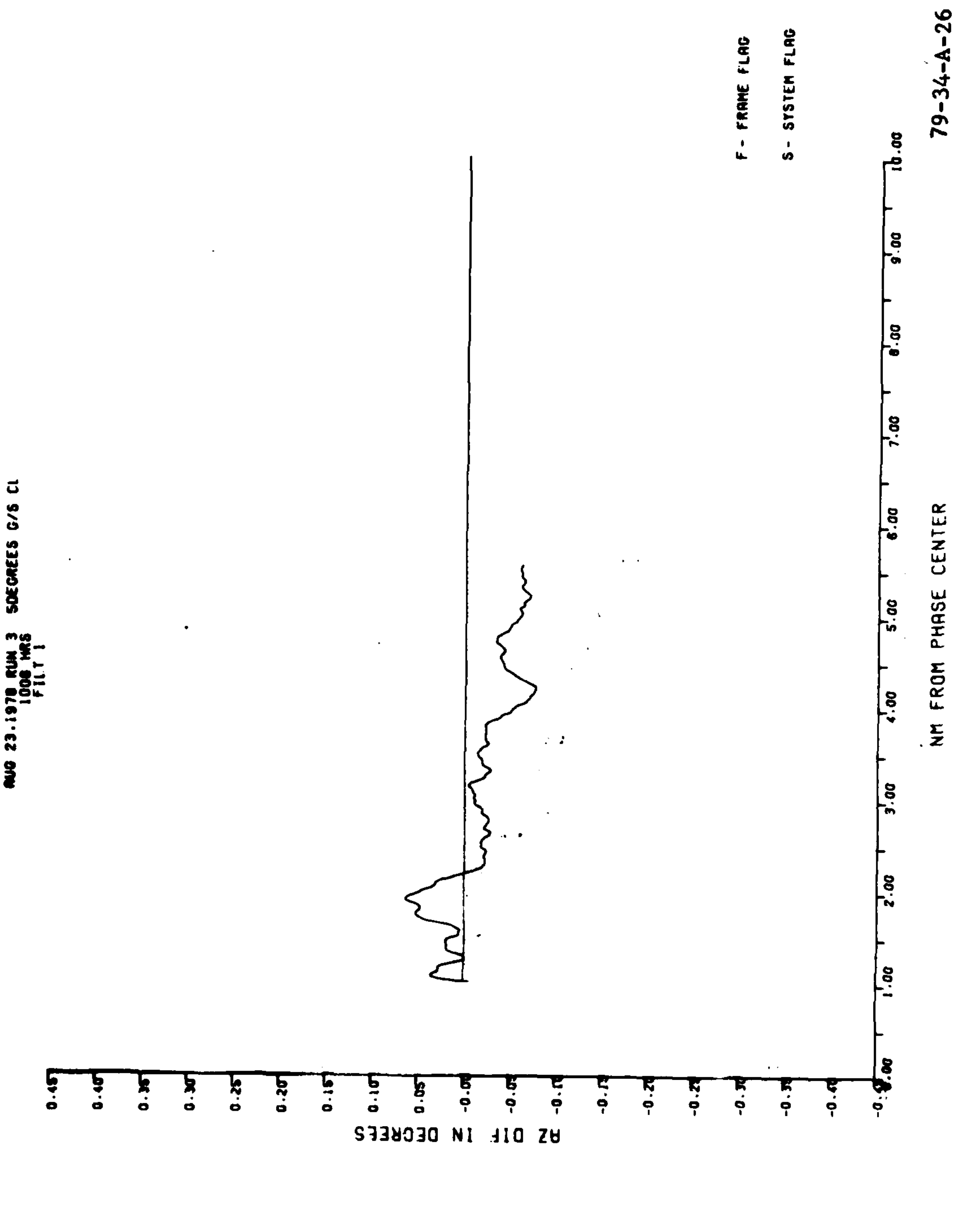

JUN 30.1978 TISE 5DEG CL APP 3ST RUN 4
1348 HRS NSG/OMNI
SYS 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
— MLS
+ TRACKER
NM FROM AZ PHASE CENTER
EL MLS AND TRACKER
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
4.10
4.20
4.30
4.40
4.50
4.60
4.70
4.80
4.90
5.00
5.10
5.20
5.30
5.40
5.50
5.60
5.70
5.80
5.90
79-34-A-22

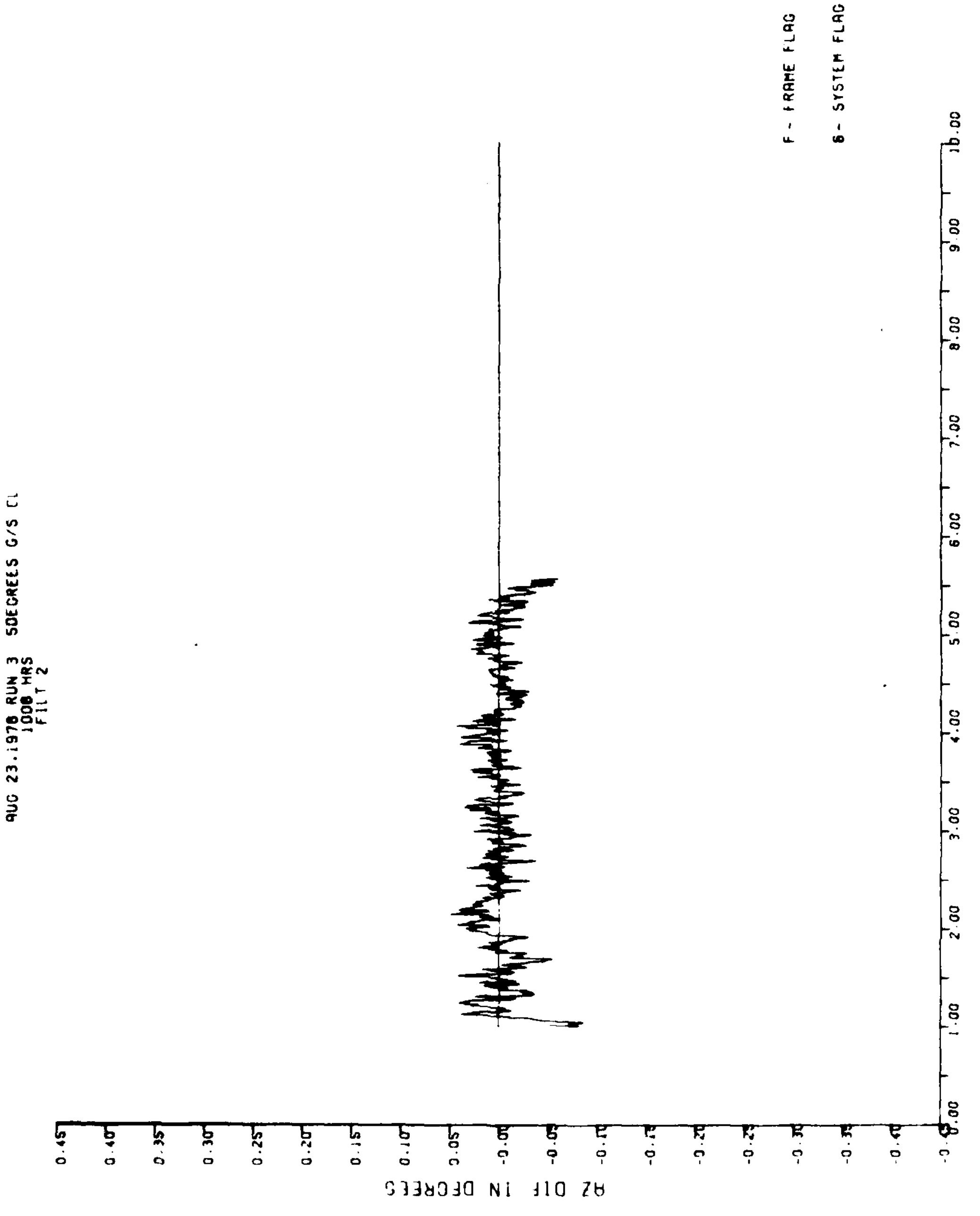

JUN 30.1978 TISC 5DEG CL APP 3S7 RUN 4
1348 HRS N5D/OMNI
FILT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM AZ PHASE CENTER
EL DIF IN DEGREES
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00

79-34-A-23

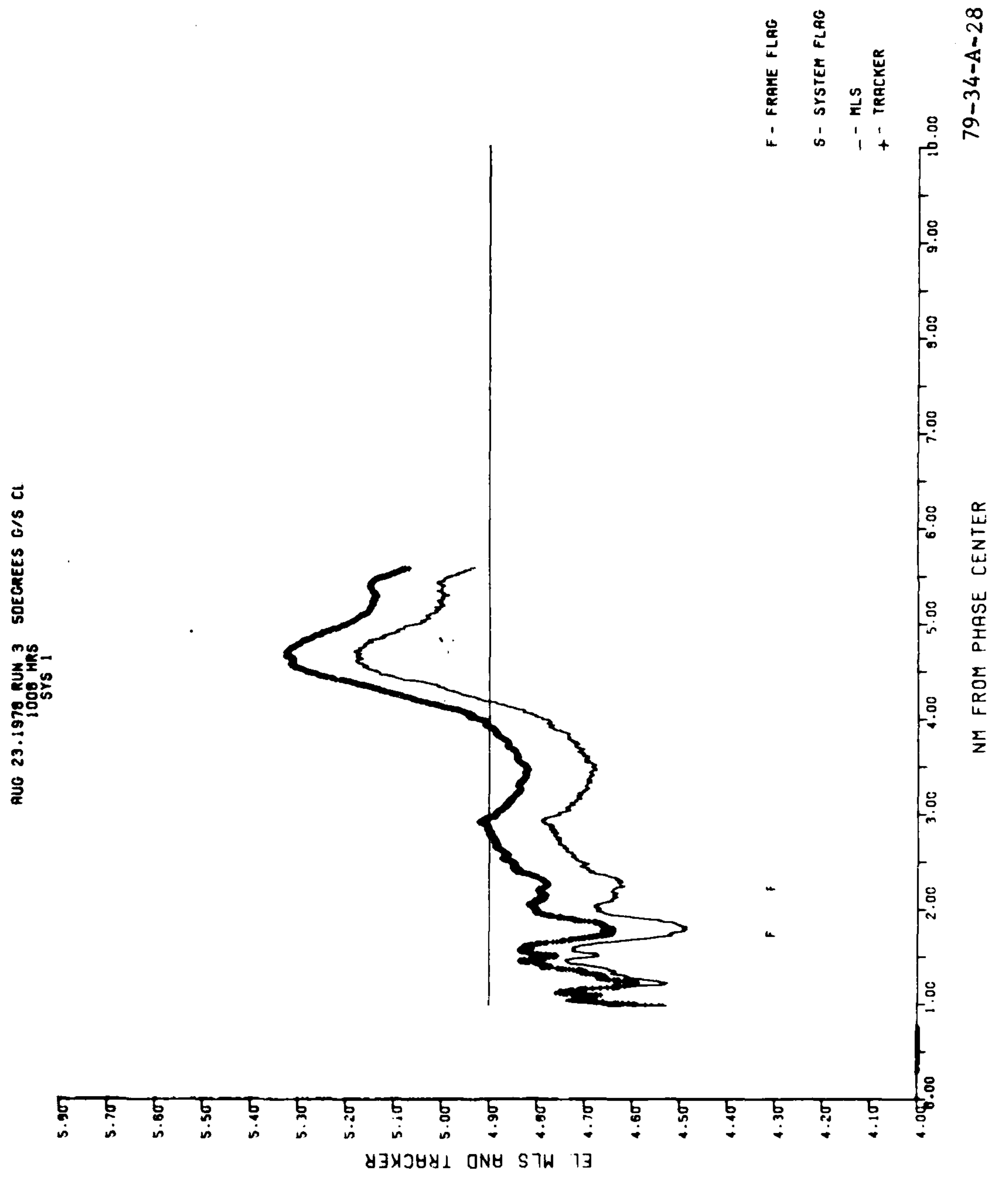

JUN 30.1978 TISC SDEG CL APP 3ST RUN 4
1340 HRS WSO/OMNI
FILT 2 BM
F- FRAME FLAG
S- SYSTEM FLAG
79-34-A-24
NM FROM AZ PHASE CENTER
EL DIF IN DEGREES
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45


AUG 23,1978 TISC 5DEG GS CL 3ST RUN 3
1008 HRS N50/OMNI
SYS 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
- - MLS
+ - TRACKER
79-34-A-25
NM FROM PHASE CENTER
AZ MLS AND TRACKER
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00

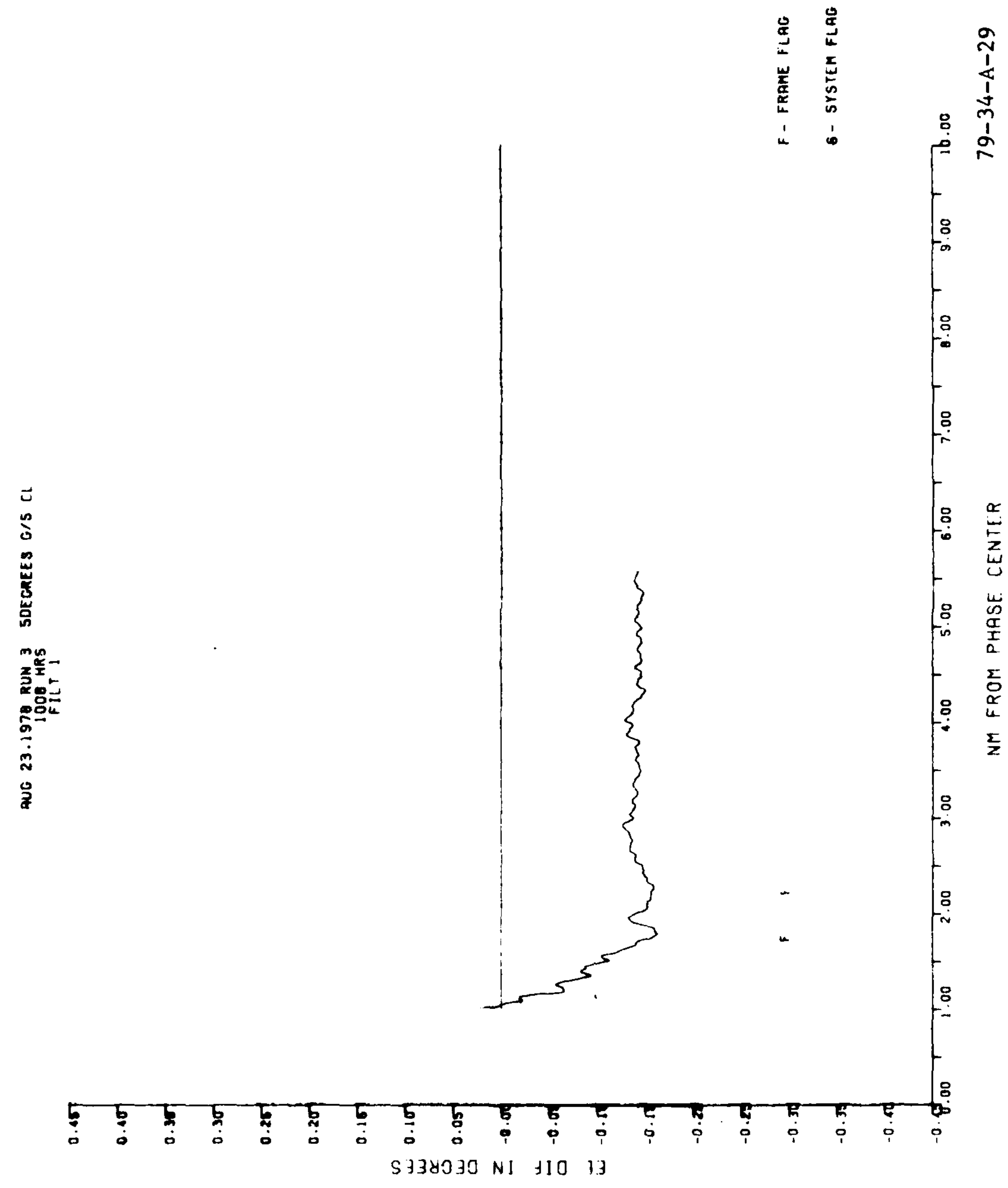

AUG 23,1978 RUN 3 5DEGREES G/S CL
1008 HRS
FILT 1
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM PHASE CENTER
AZ DIF IN DEGREES
79-34-A-26

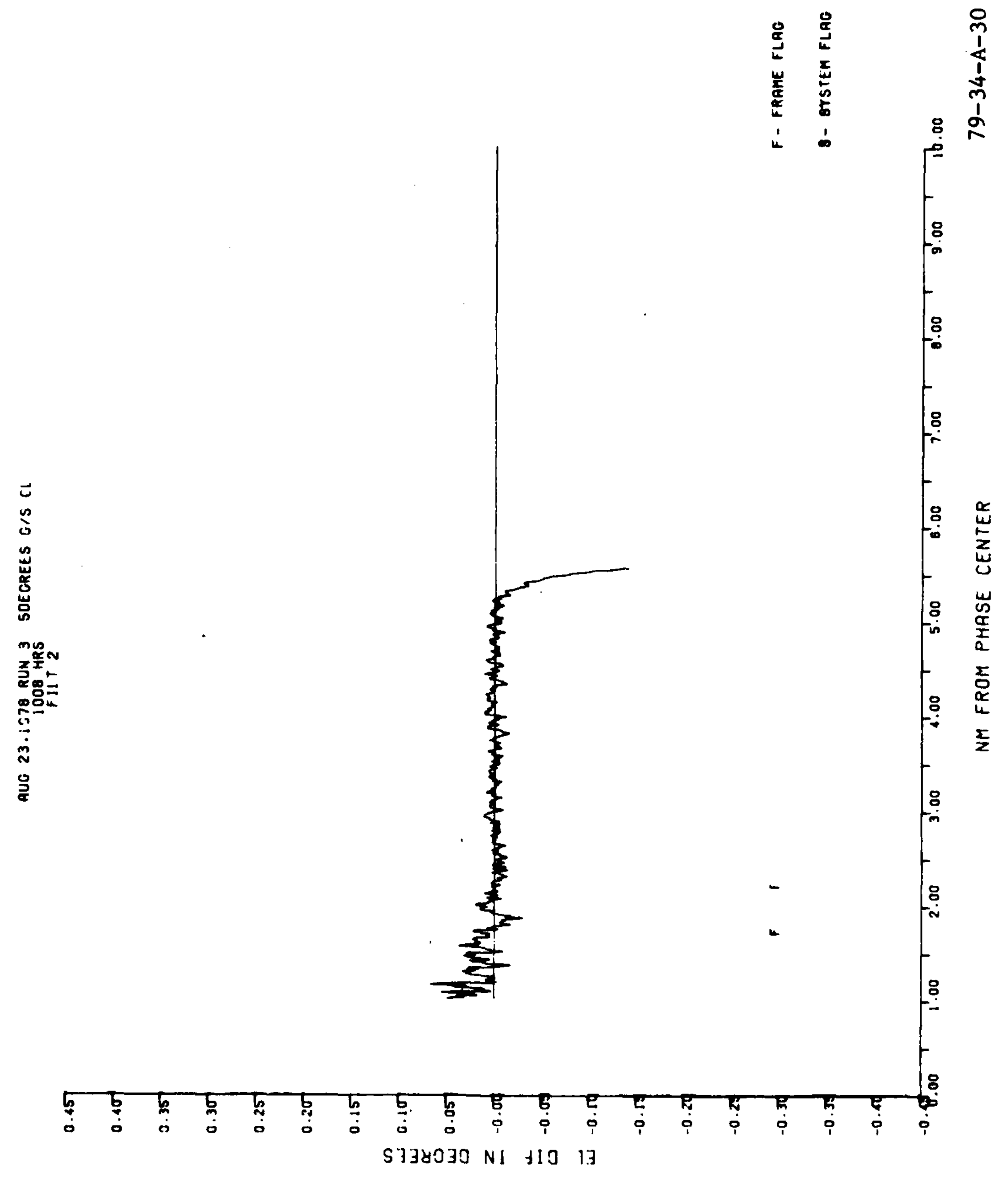

AUG 23,1978 RUN 3 5DEGREES G/S CL
1008 HRS
FILT 2
AZ DIF IN DEGREES
NM FROM PHASE CENTER
F - FRAME FLAG
G - SYSTEM FLAG

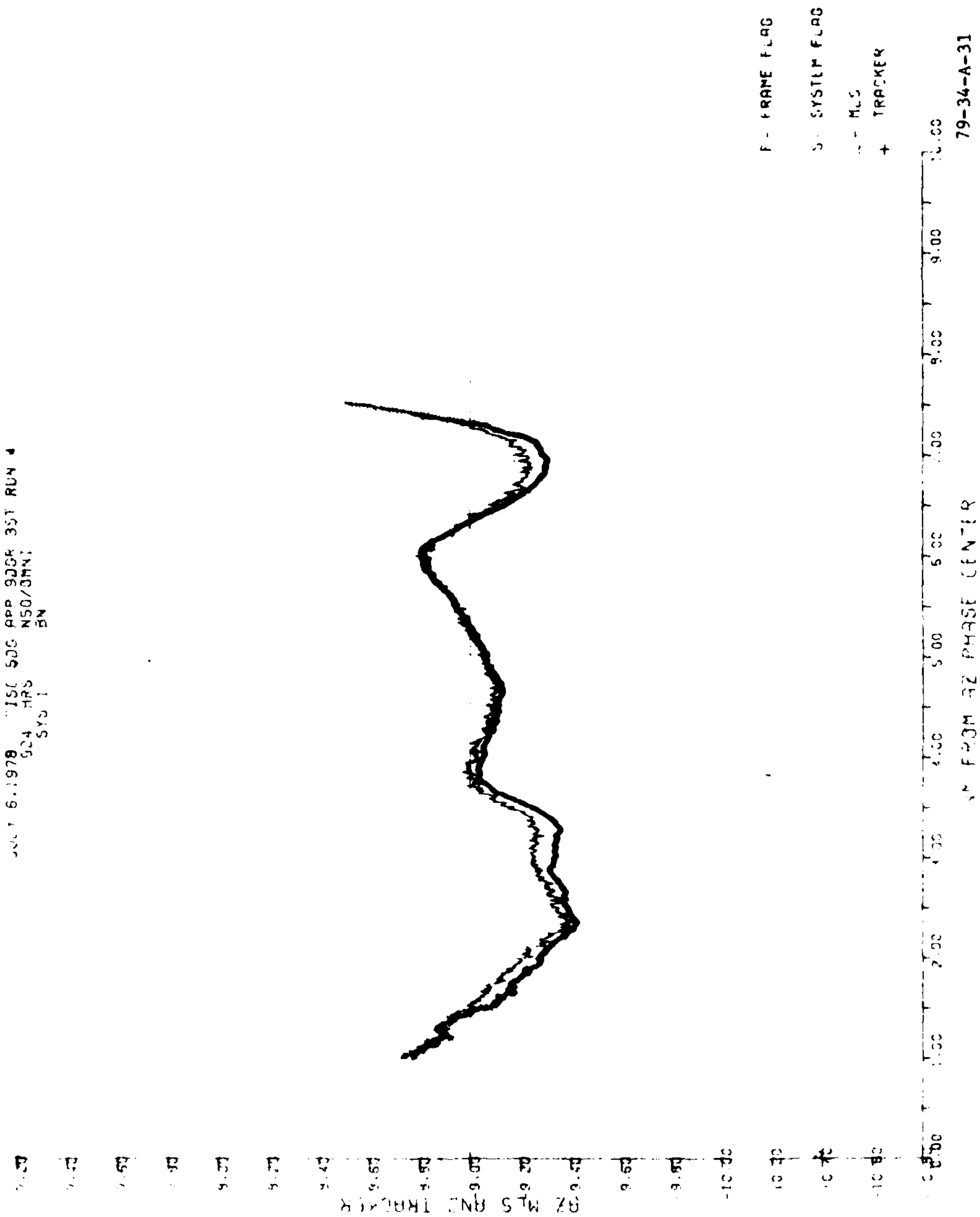
79-34-A-27

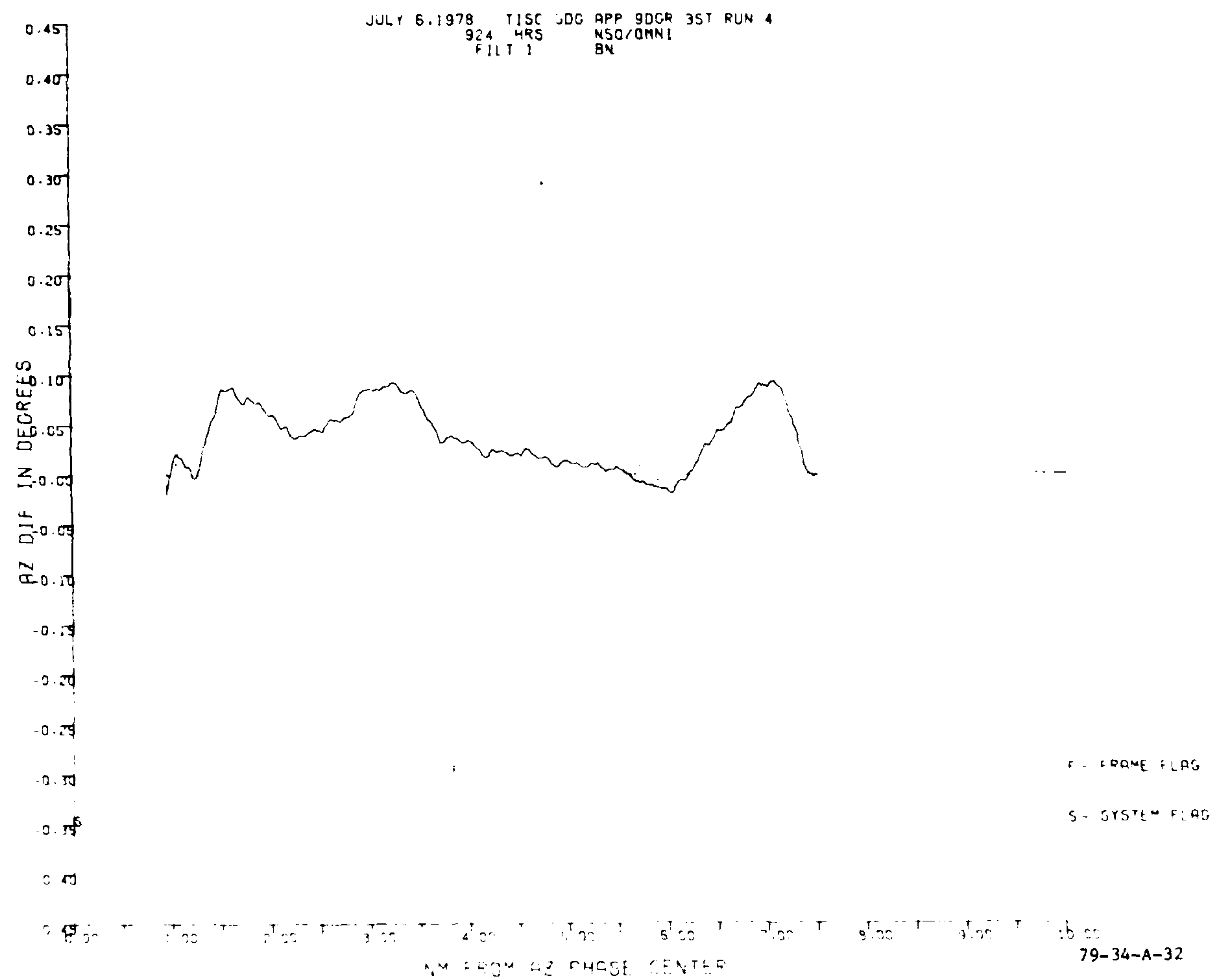


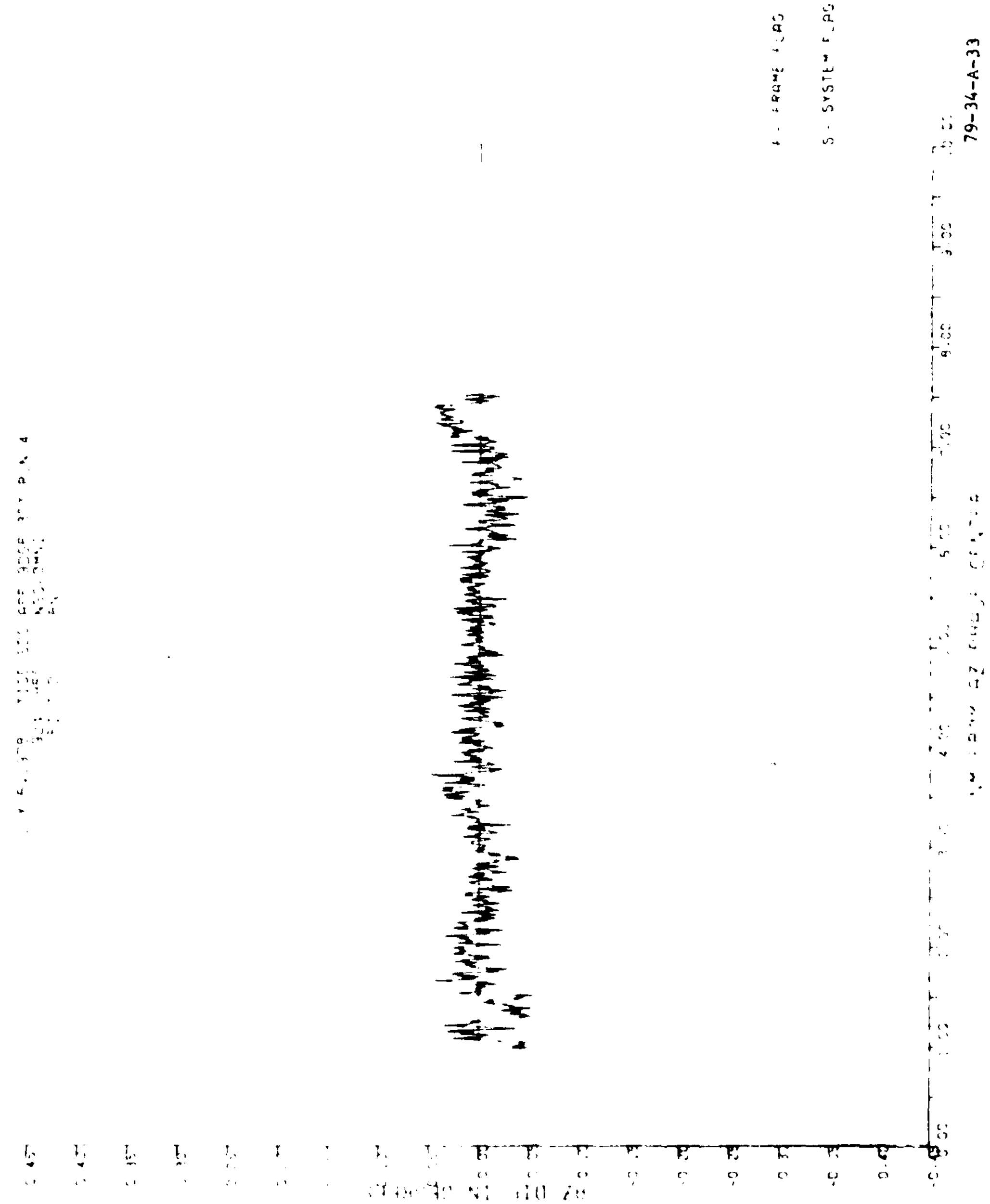
AUG 23.1978 RUN 3 5DEGREES G/S CL
1008 HRS
SYS 1
F - FRAME FLAG
S - SYSTEM FLAG
— - MLS
+ - TRACKER
EL MLS AND TRACKER
NM FROM PHASE CENTER
79-34-A-28


AUG 23.1978 RUN 3 5DEGREES G/S CL
1008 HRS
FILT 1
F - FRAME FLAG
G - SYSTEM FLAG
NM FROM PHASE CENTER
EL DIF IN DEGREES
79-34-A-29

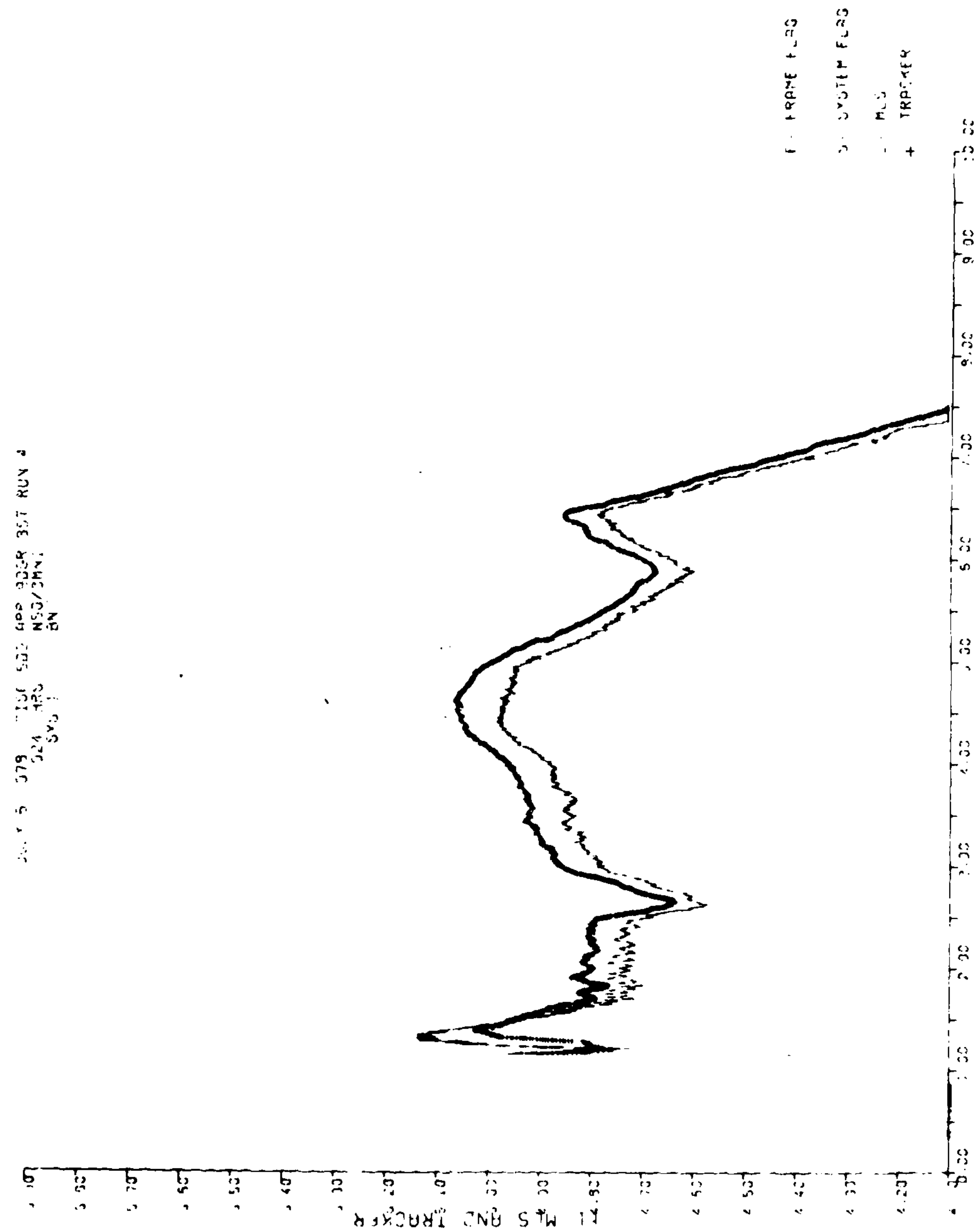

AUG 23.1978 RUN 3 5DEGREES G/S CL
1008 HRS
FILT 2
F- FRAME FLAG
S- SYSTEM FLAG
NM FROM PHASE CENTER
EL DIF IN DEGREES
79-34-A-30


F - FRAME FLAG
S - SYSTEM FLAG
MLS
+ TRACKER
79-34-A-31
AZ MLS AND TRACKER
FROM AZ PHASE CENTER

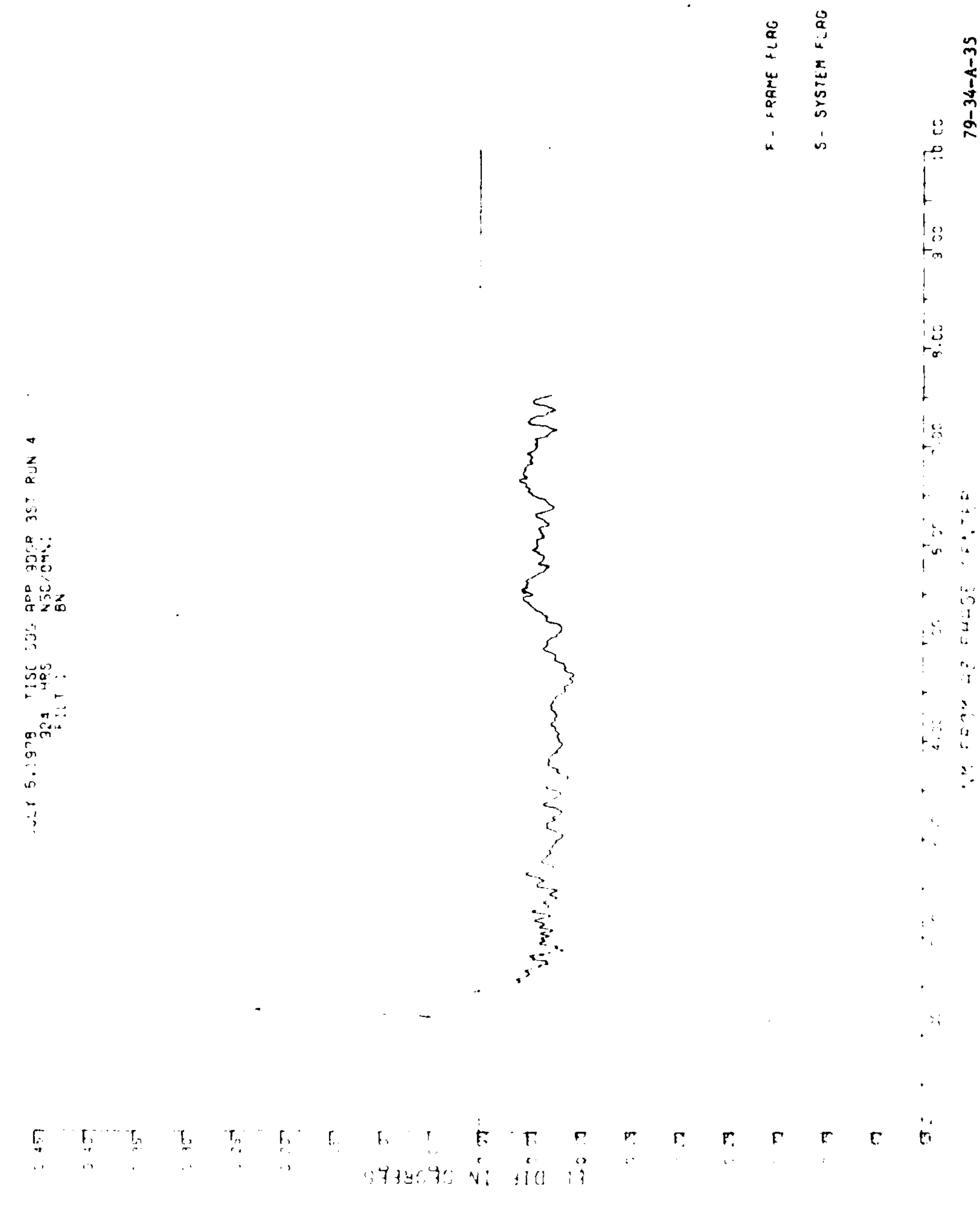

JULY 6,1978 TISC 5DG APP 9DGR 3ST RUN 4
924 HRS NSO/OMNI
FILT 1 BN
AZ DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-32

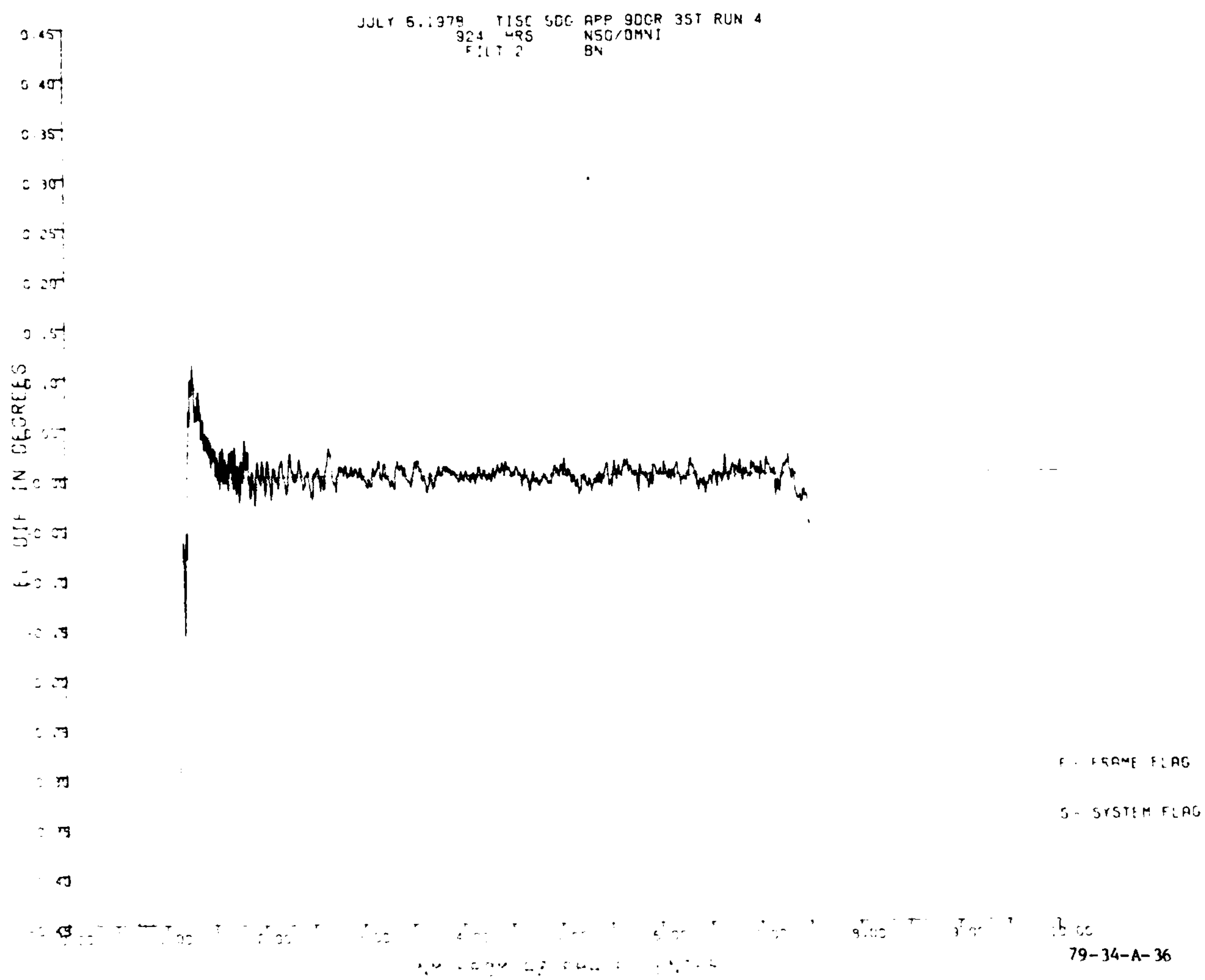


79-34-A-33

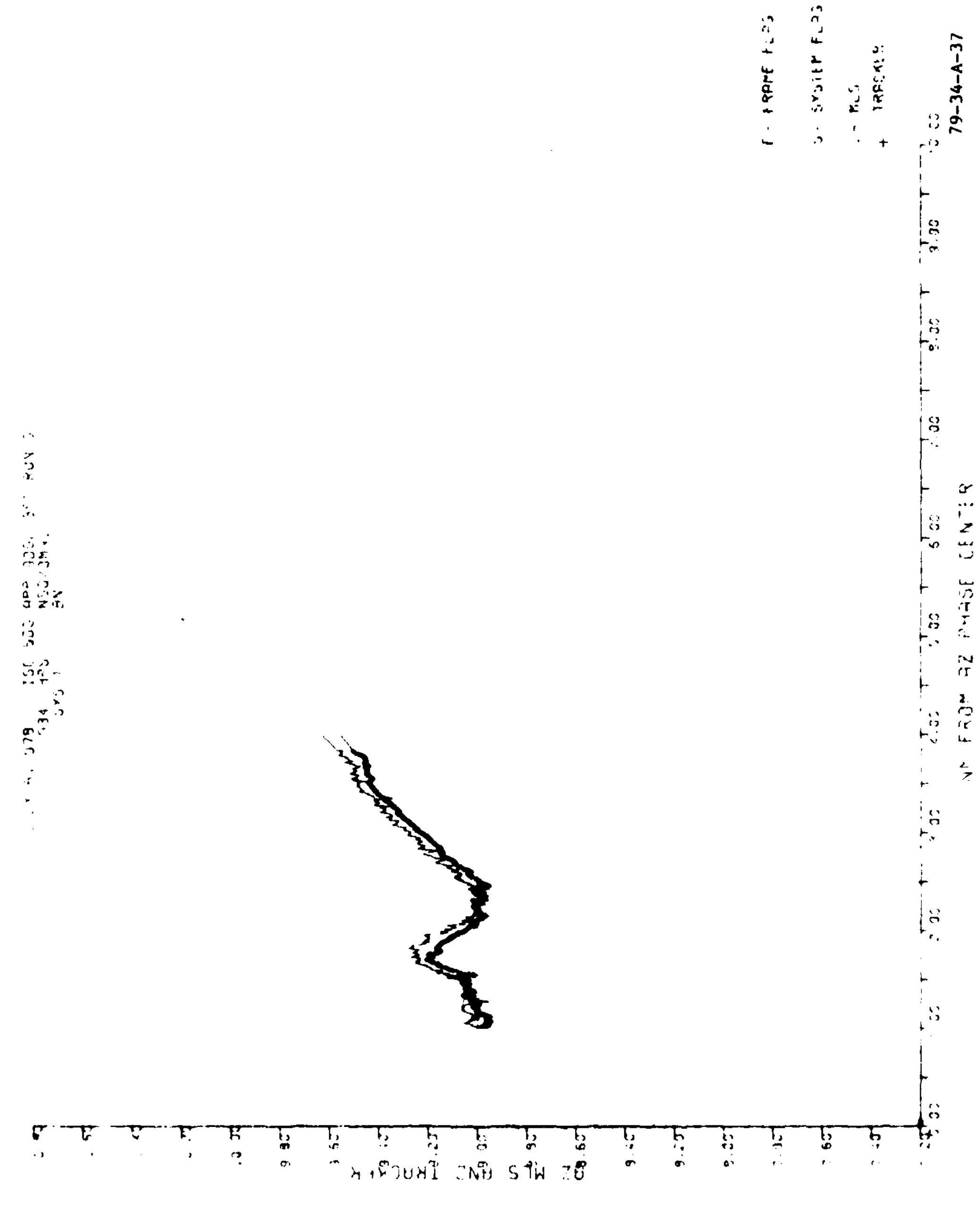


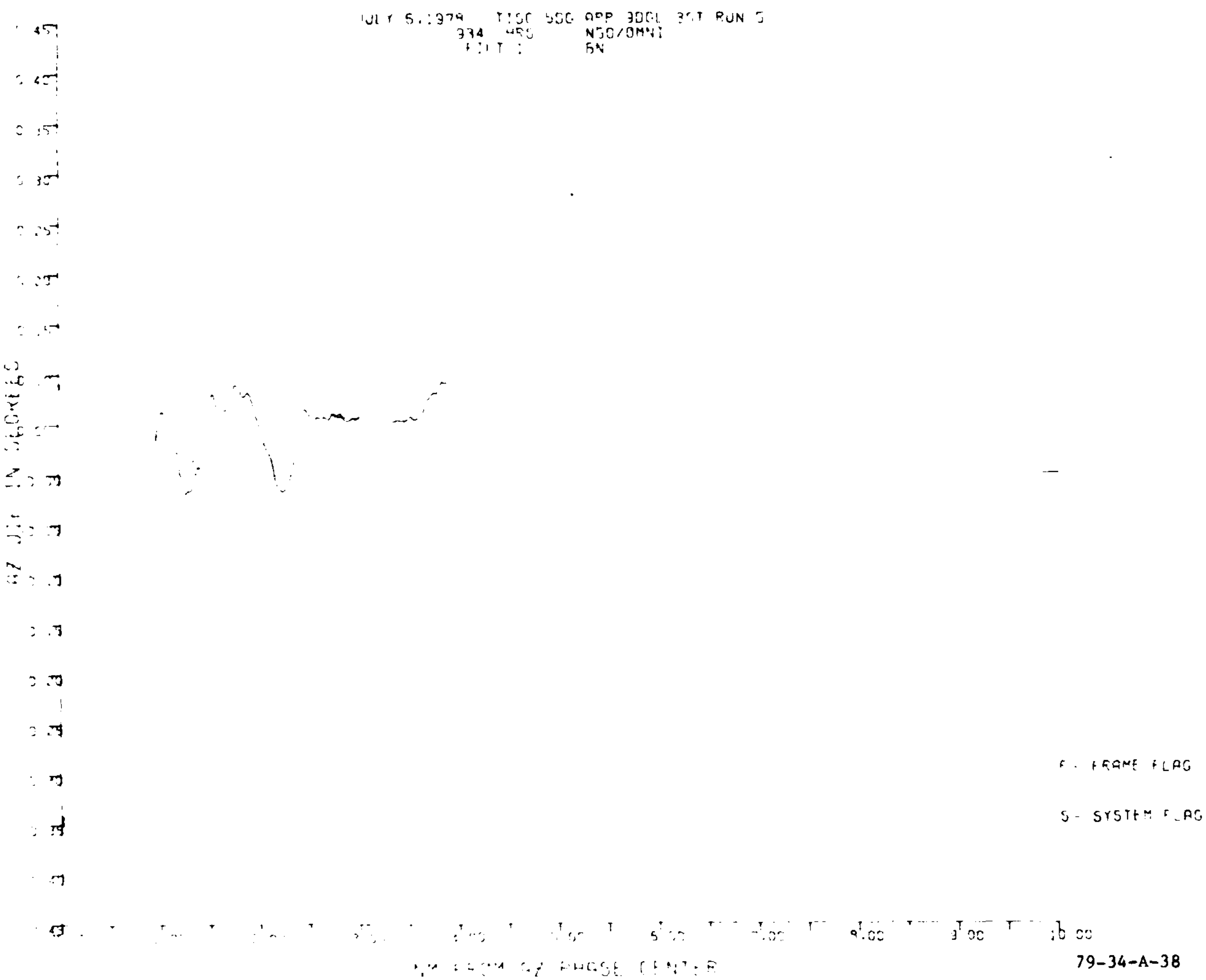
79-34-A-34


F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-35

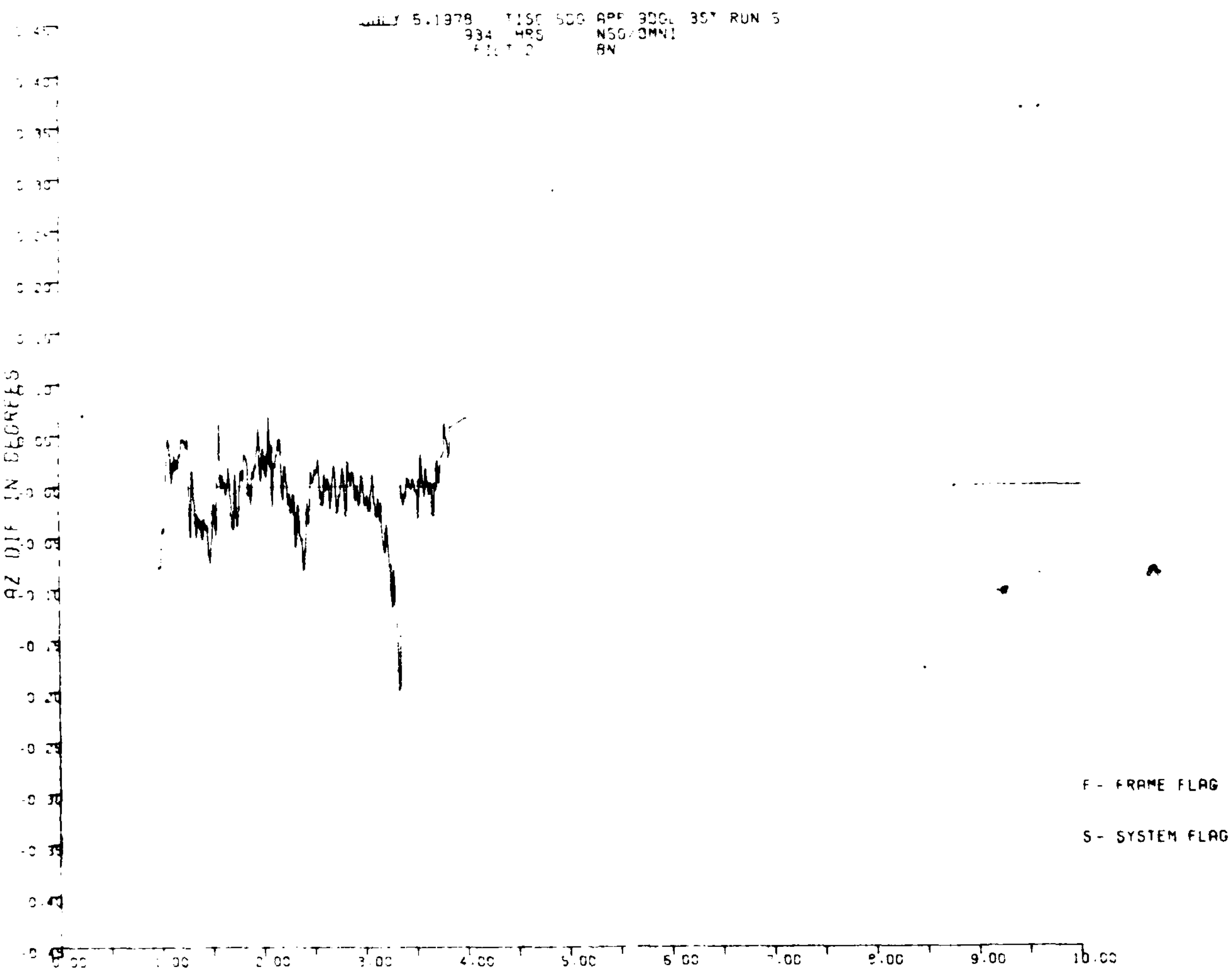

JULY 6,1978 TISC SDG APP 9DGR 3ST RUN 4
924 HRS NSO/OMNI
FILT 2 BN
0.45
0.40
0.35
0.30
0.25
0.20
IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-36

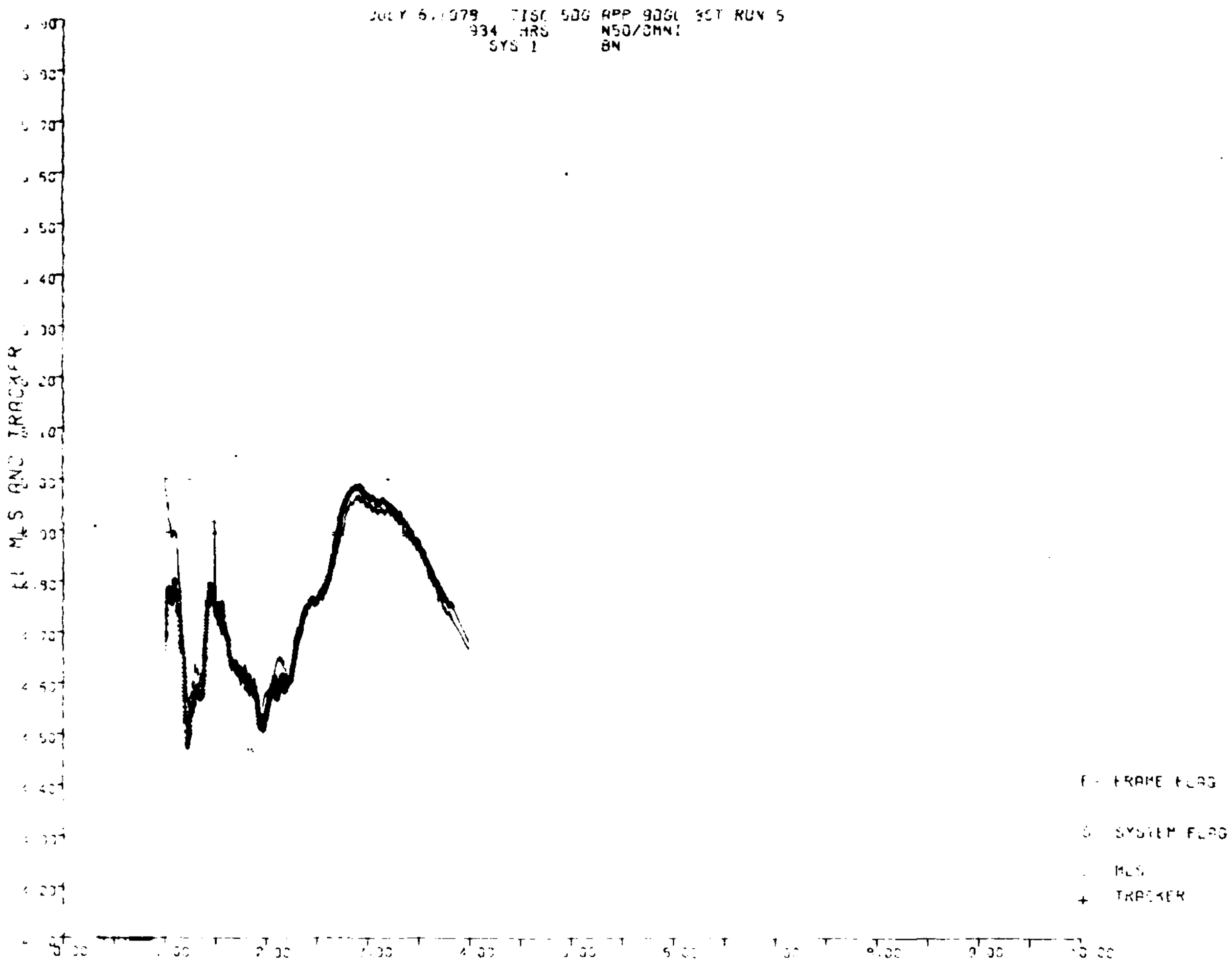

79-34-A-37



79-34-A-38

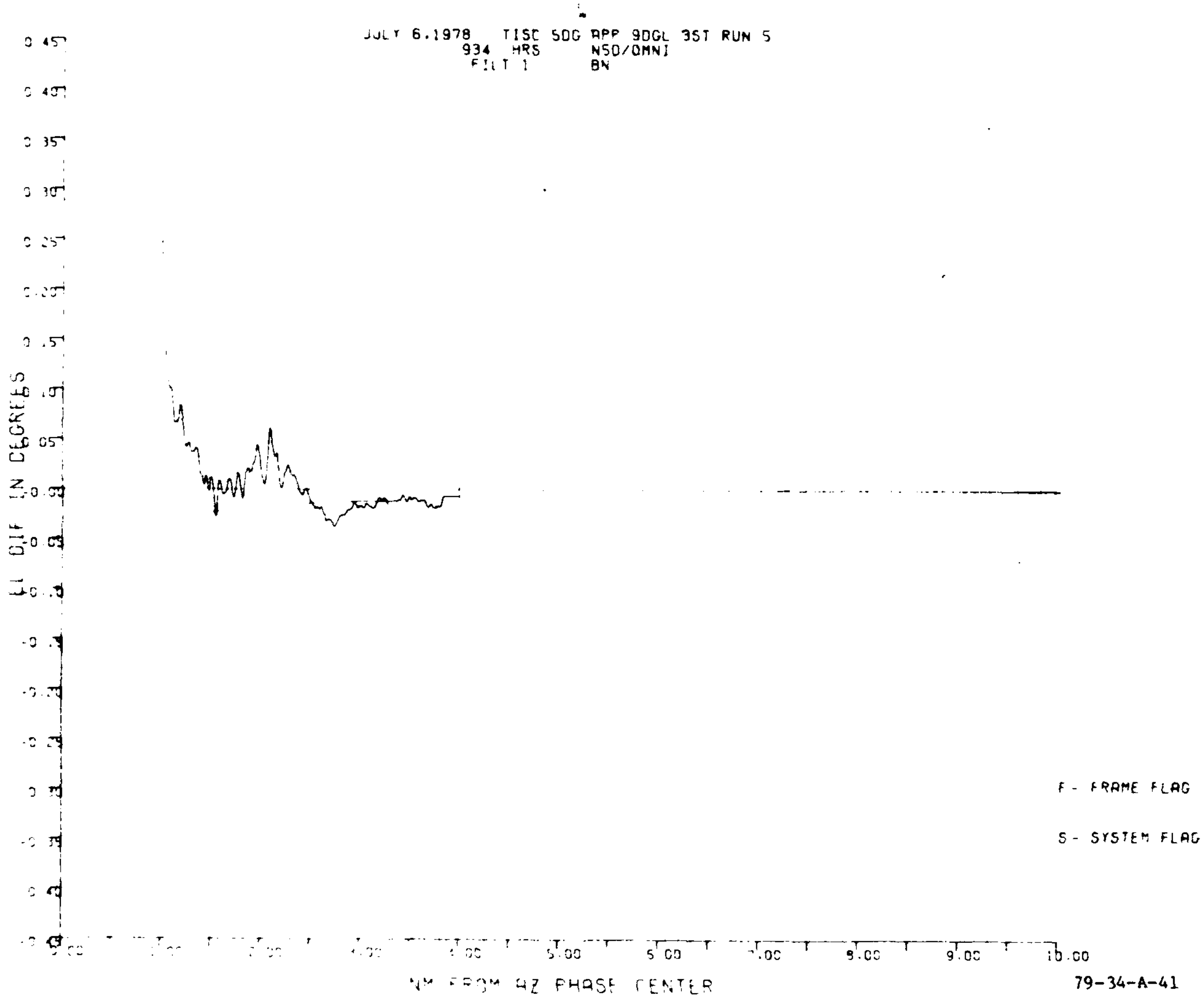

JULY 5,1978 TISC 500 APF 300L 35T RUN 5
934 HRS NSG/OMNI
BN
AZ DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-39



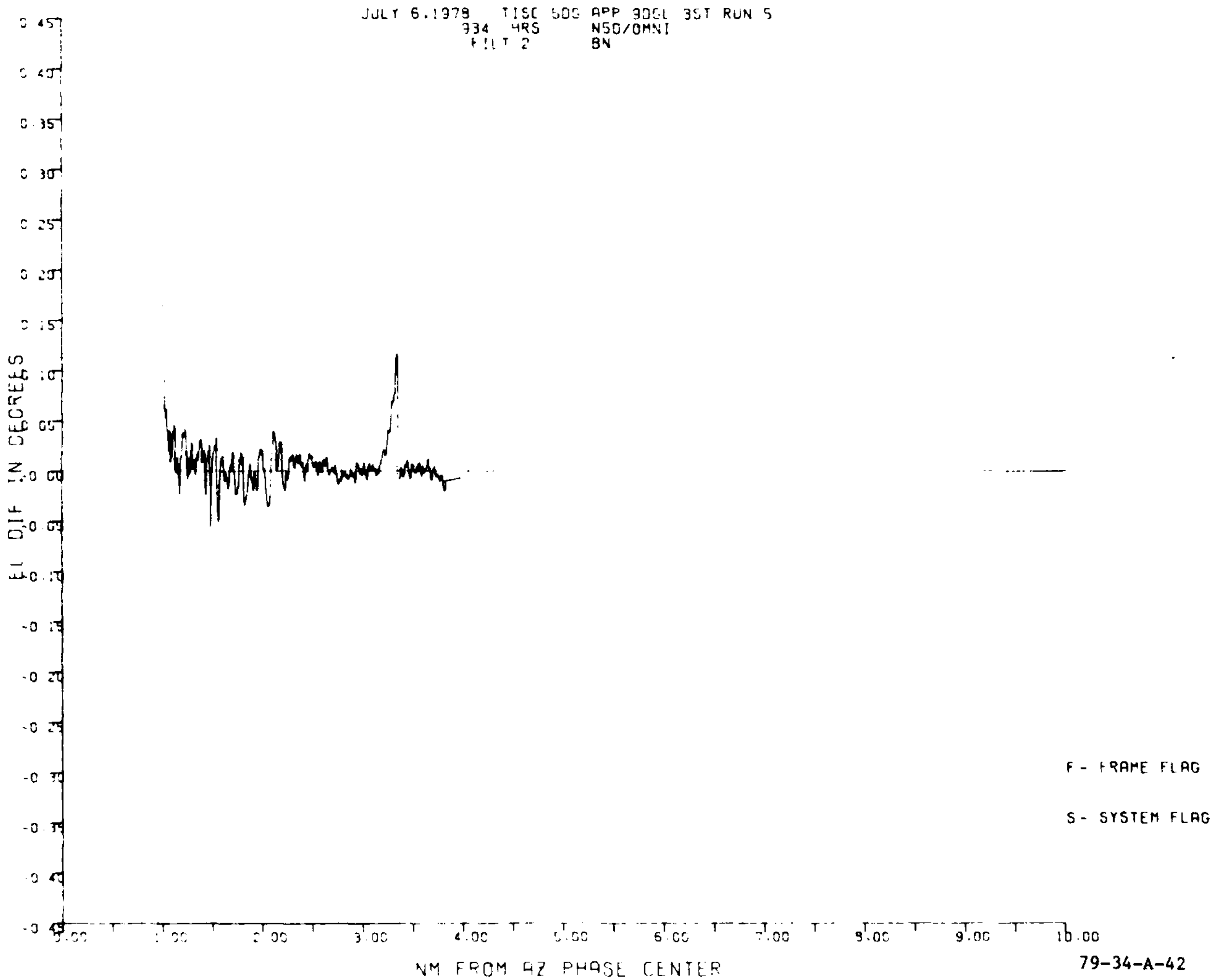
JULY 6, 1979 TISC 5DG APP 9DGL 3ST RUN 5
934 HRS N50/OMNI
SYS 1 8N
NM FROM AZ PHASE CENTER
MLS AND TRACKER
F FRAME FLAG
S SYSTEM FLAG
MLS
+ TRACKER

79-34-A-40

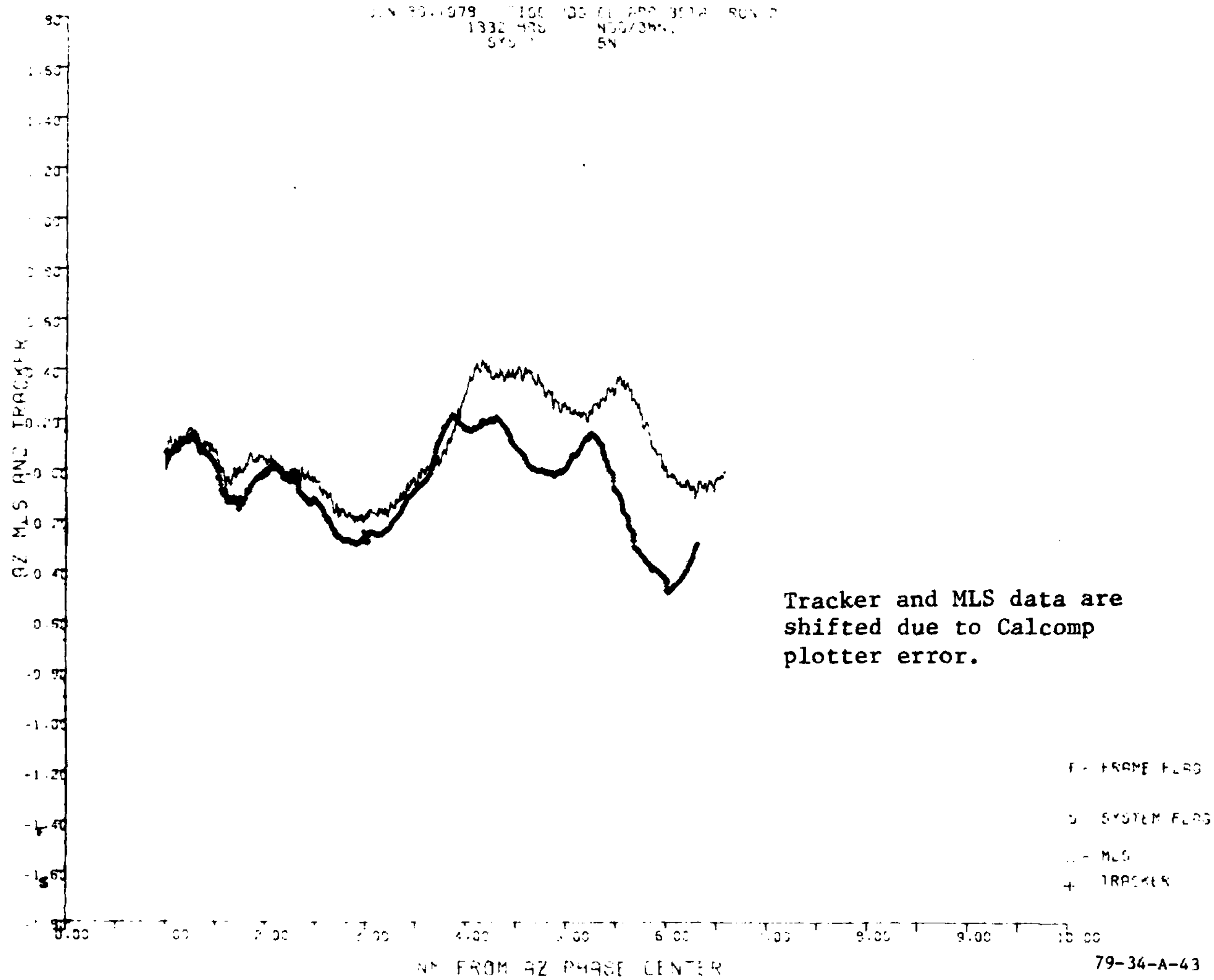


JULY 6,1978 TISC 5DG APP 9DGL 3ST RUN 5
934 HRS NSD/OMNI
FILT 1 BN
EL DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-41

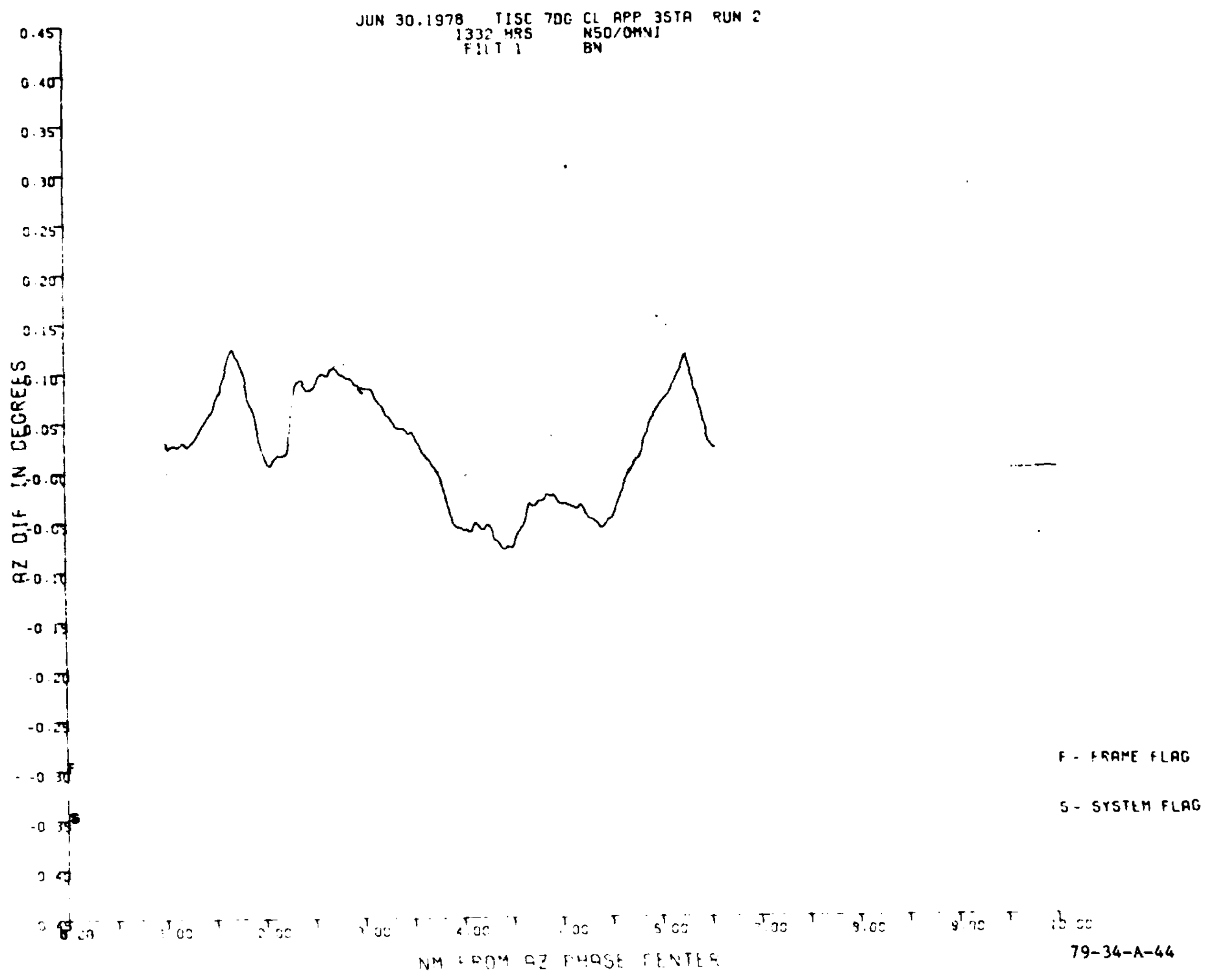

JULY 6,1979 TISC 50S APP 3DGL 35T RUN 5
934 HRS N50/OMNI
FILT 2 BN
EL DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-42

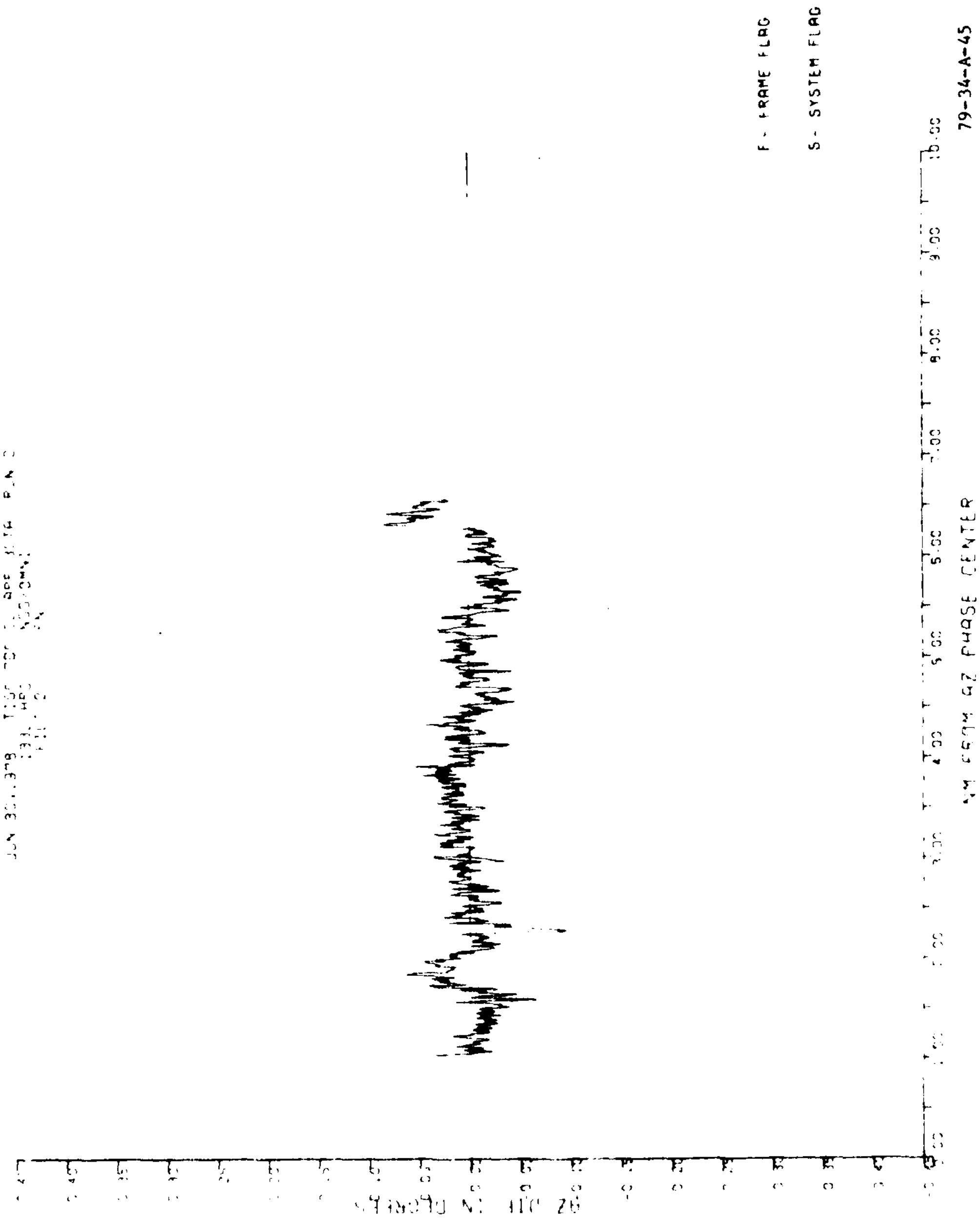


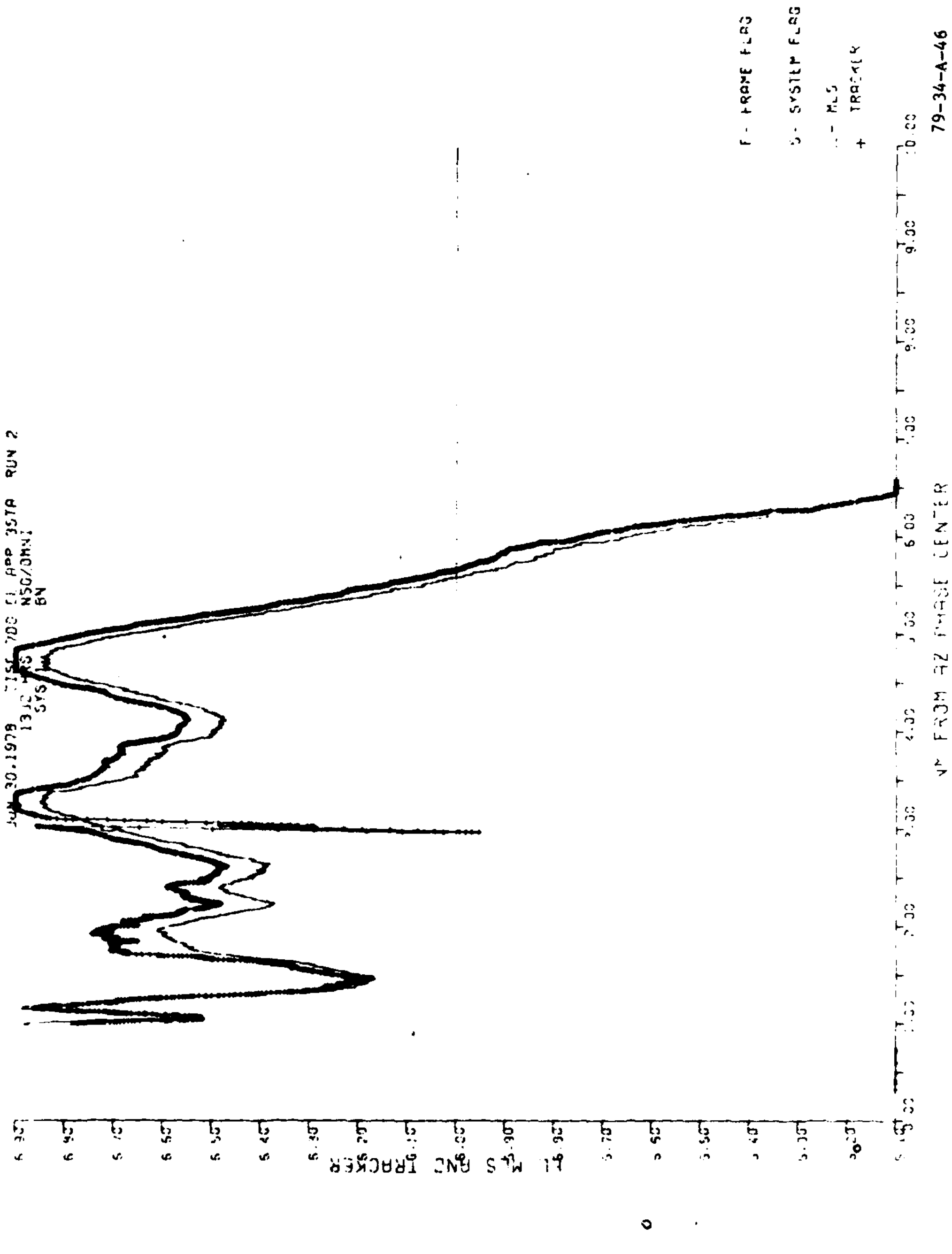
Tracker and MLS data are shifted due to Calcomp plotter error.

79-34-A-43

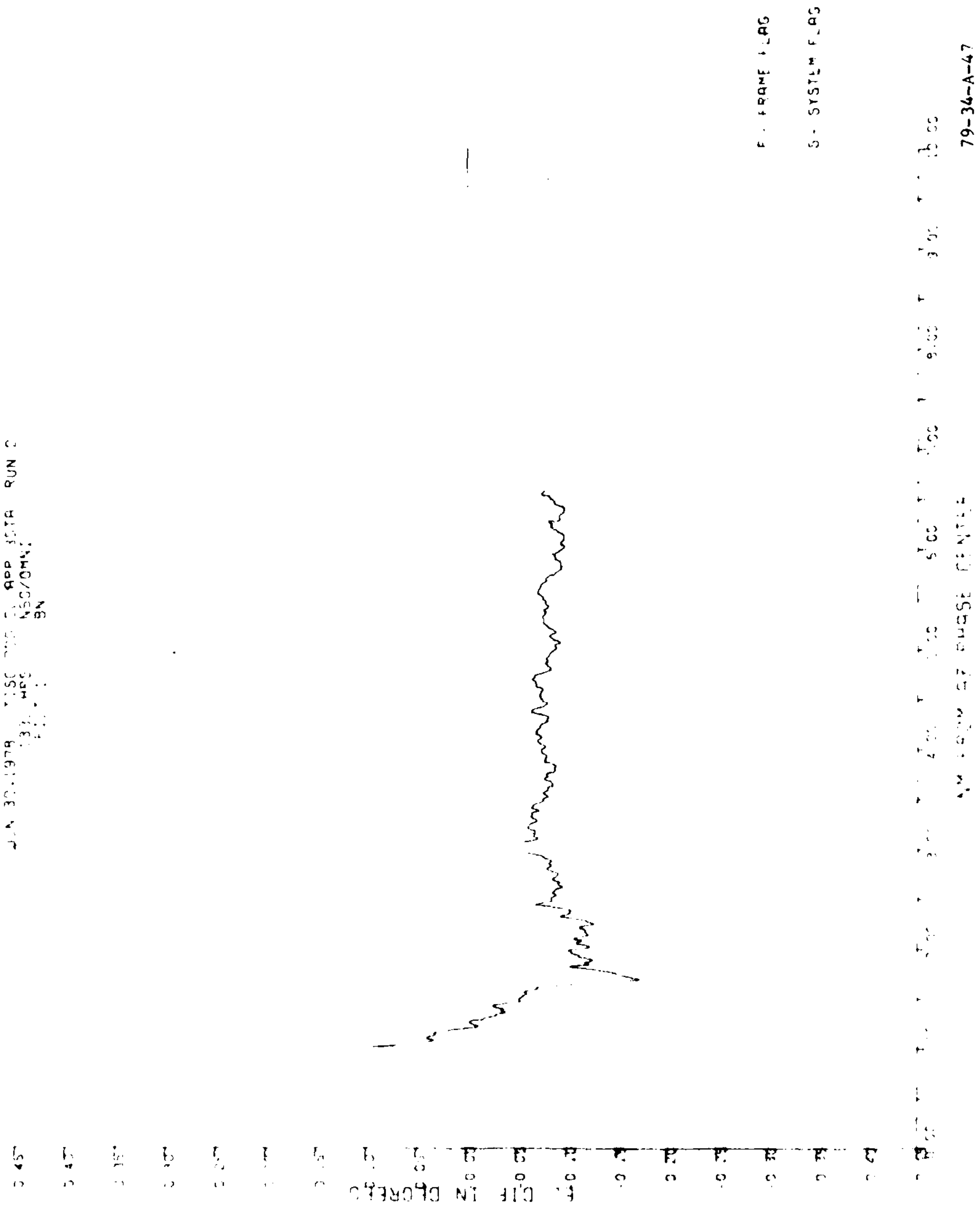

JUN 30.1978 TISC 7DG CL APP 35TA RUN 2
1332 HRS N50/OMNI
FILT 1 BN
AZ DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

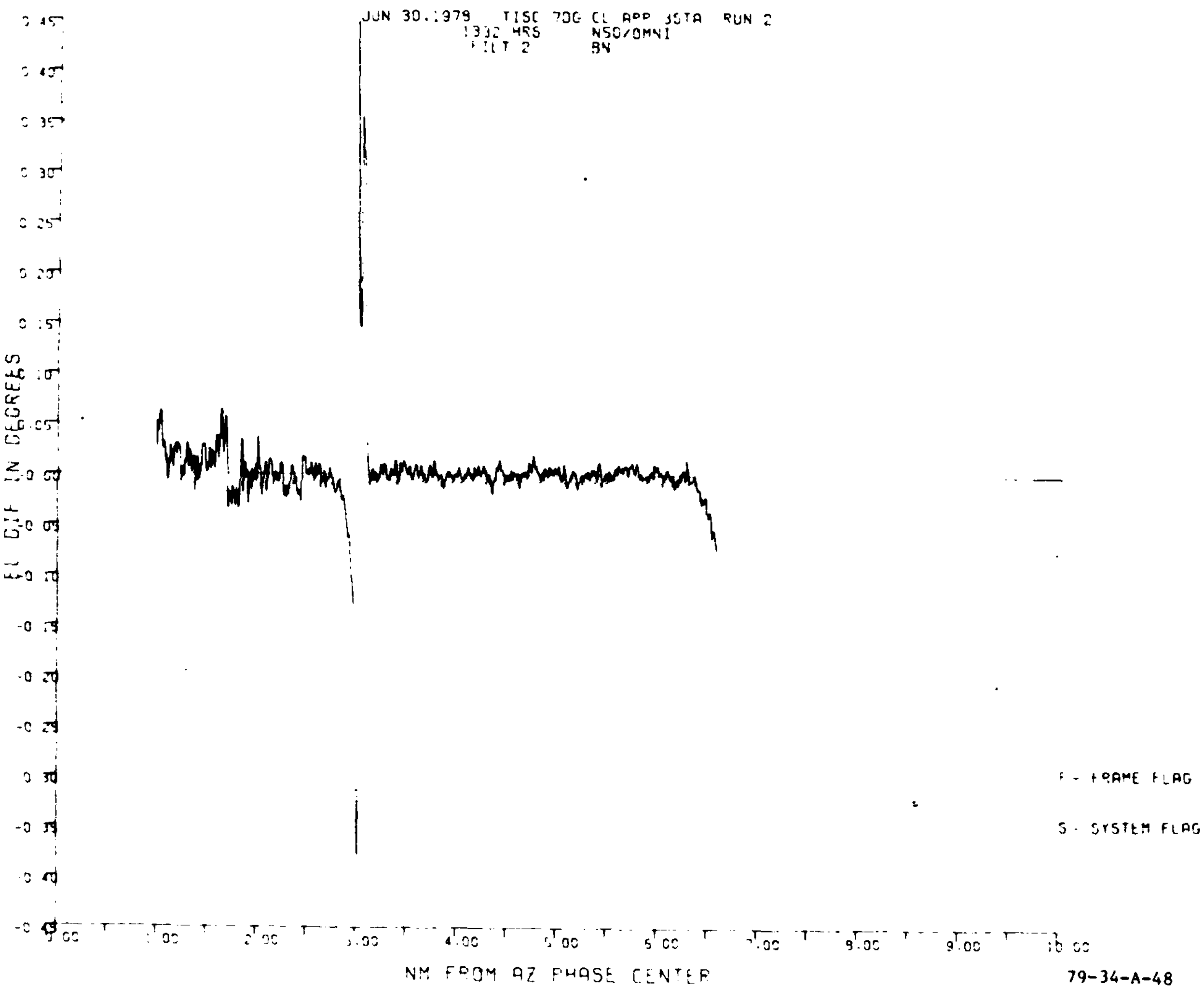
79-34-A-44


F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-45
KM FROM AZ PHASE CENTER

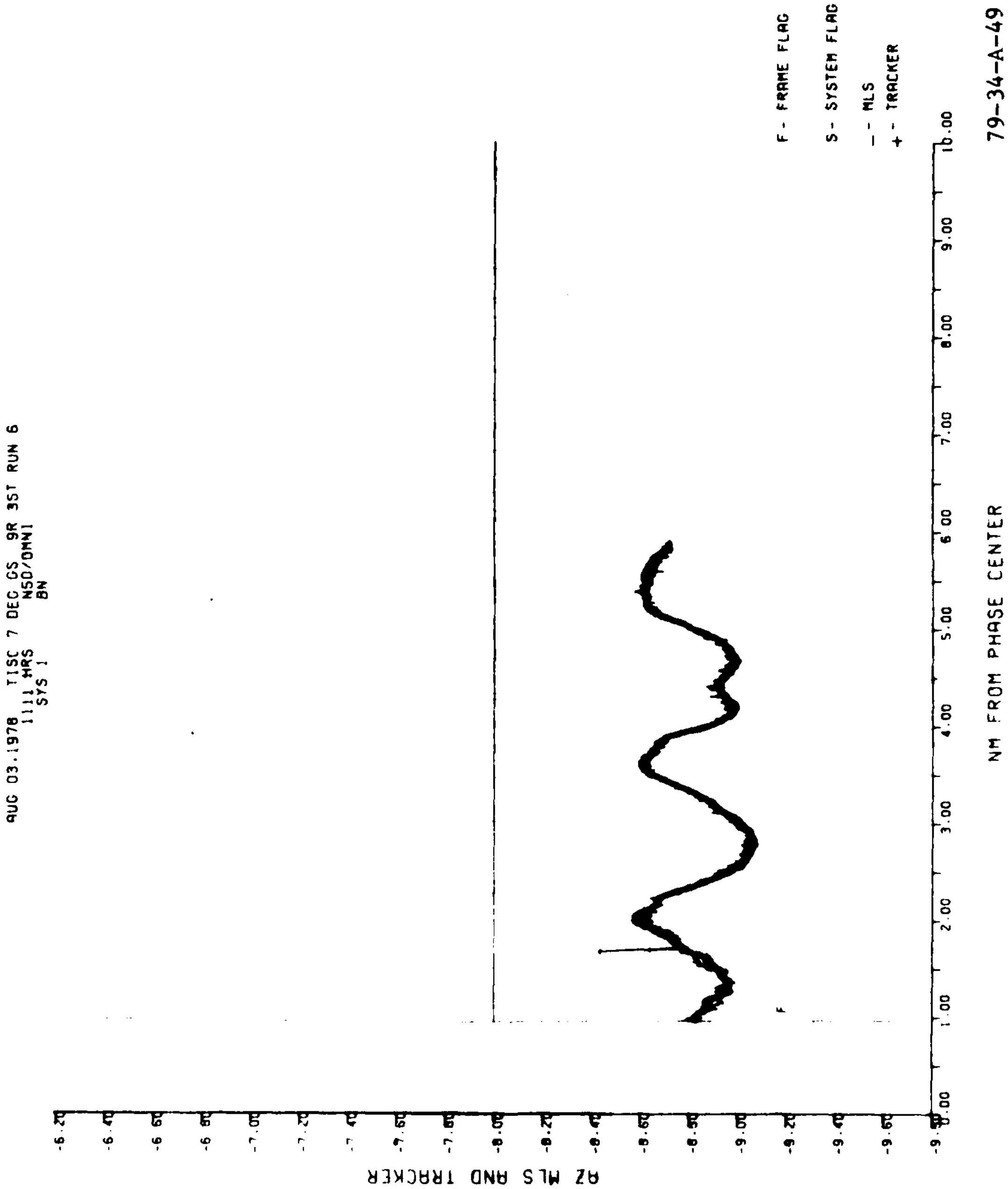


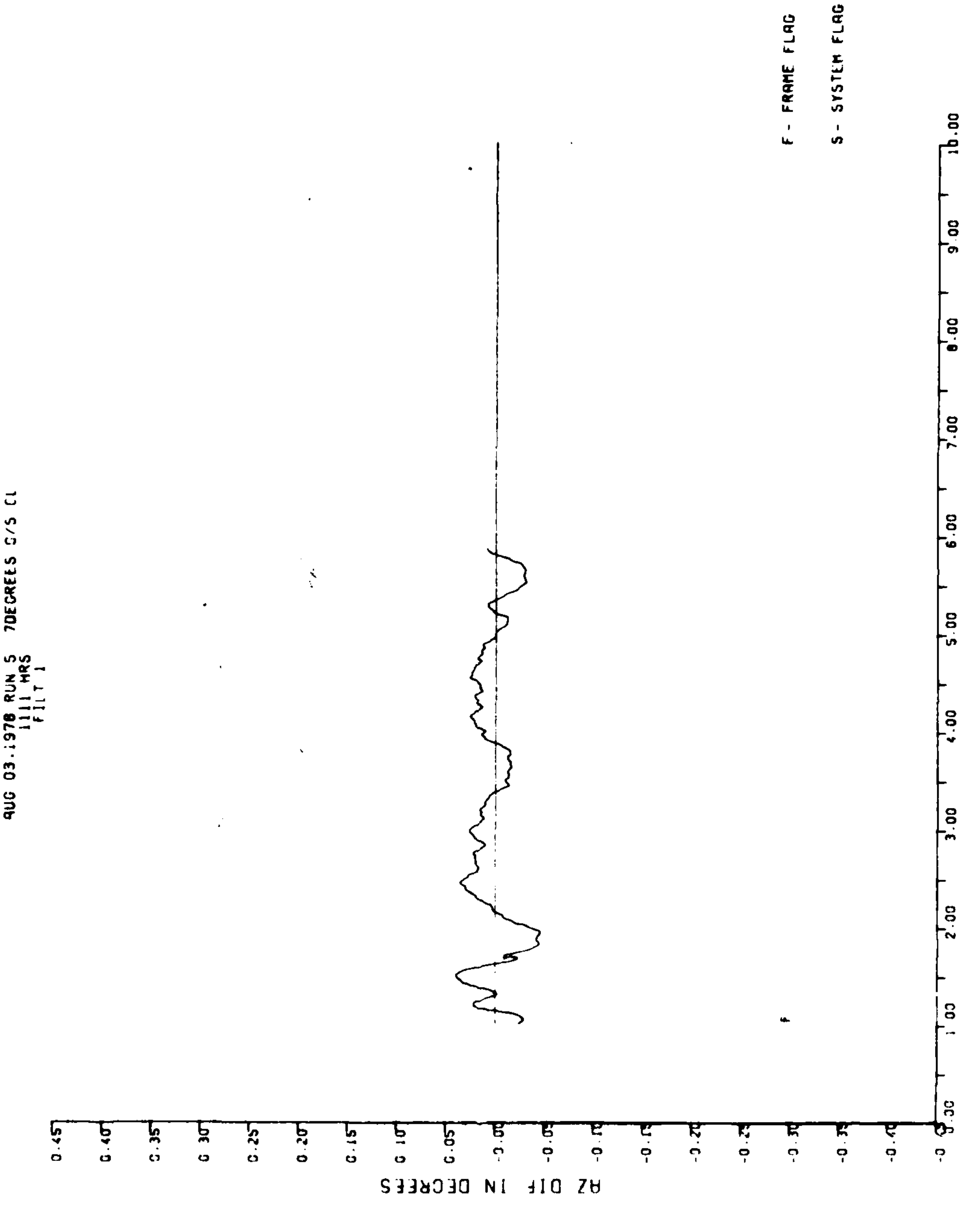
RUN 2
F - FRAME FLAG
S - SYSTEM FLAG
MLS
+ TRACKER
79-34-A-46


F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-47

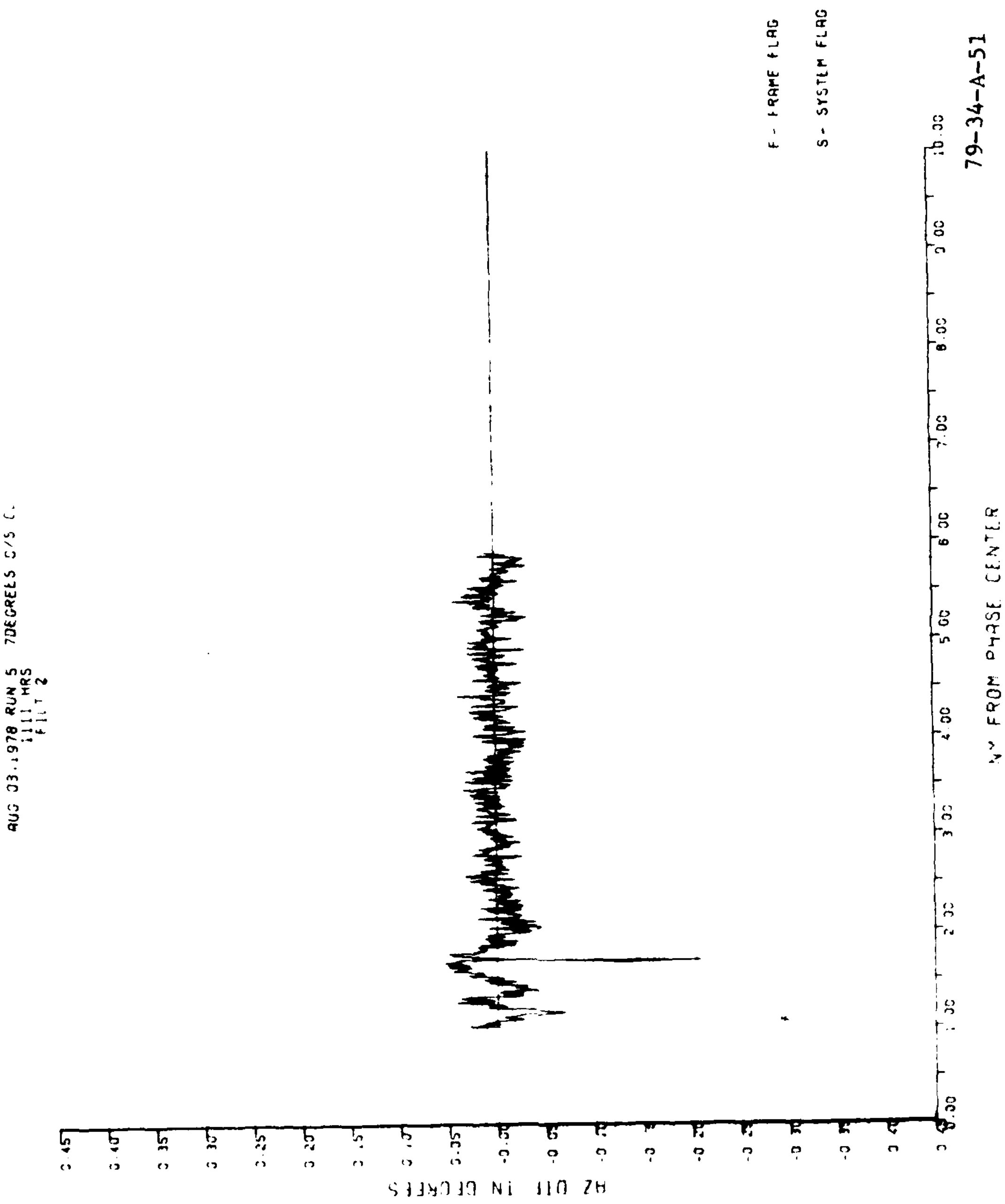

JUN 30,1979 TISC 70G CL APP 3STA RUN 2
1332 HRS NSO/OMNI
FILT 2 BN
EL DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

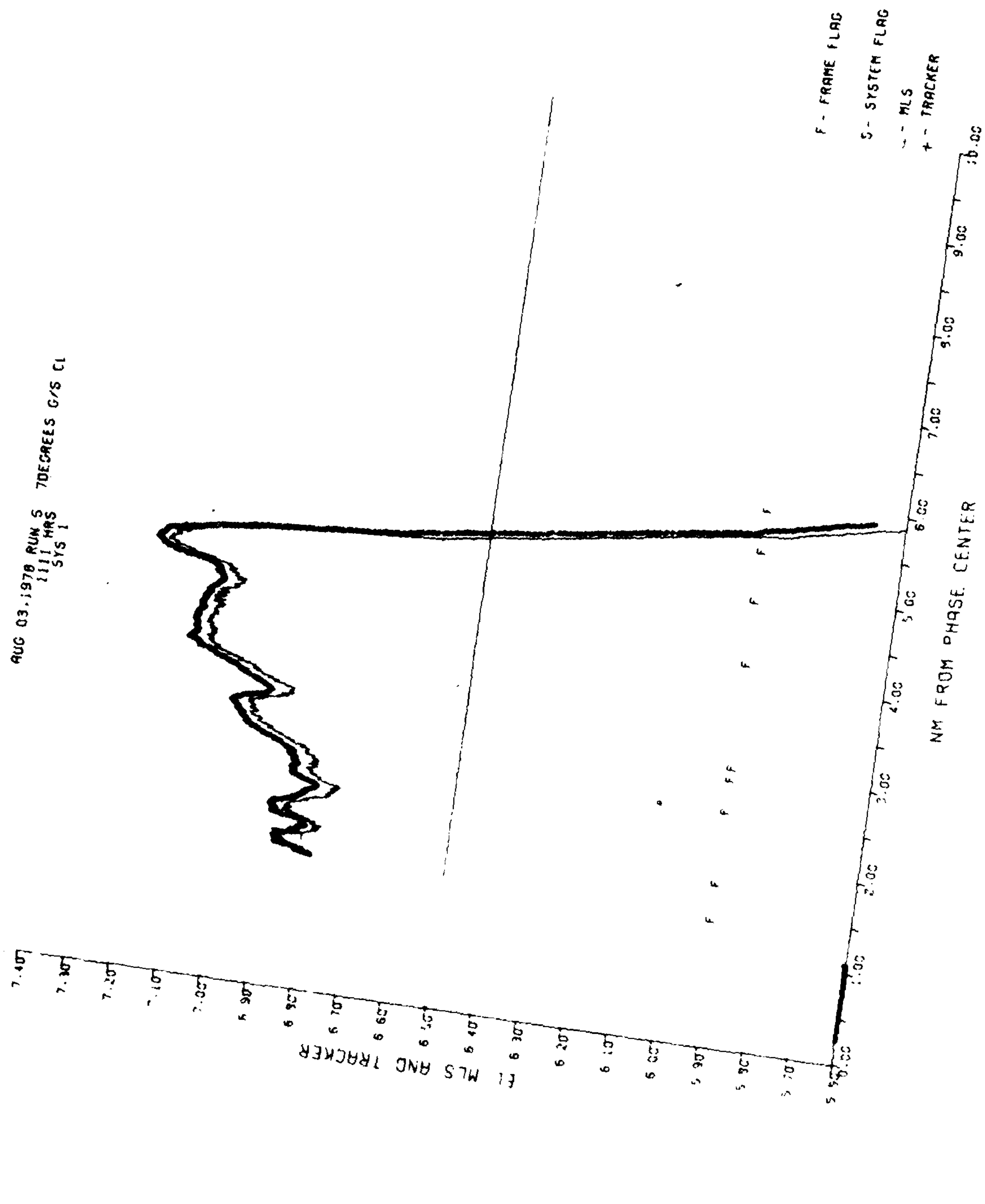
79-34-A-48


AUG 03.1978 TISC 7 DEG GS 9R 3ST RUN 6
1111 HRS N5D/OMNI
SYS 1 BN
AZ MLS AND TRACKER
NM FROM PHASE CENTER
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
F - FRAME FLAG
S - SYSTEM FLAG
- - MLS
+ - TRACKER
79-34-A-49

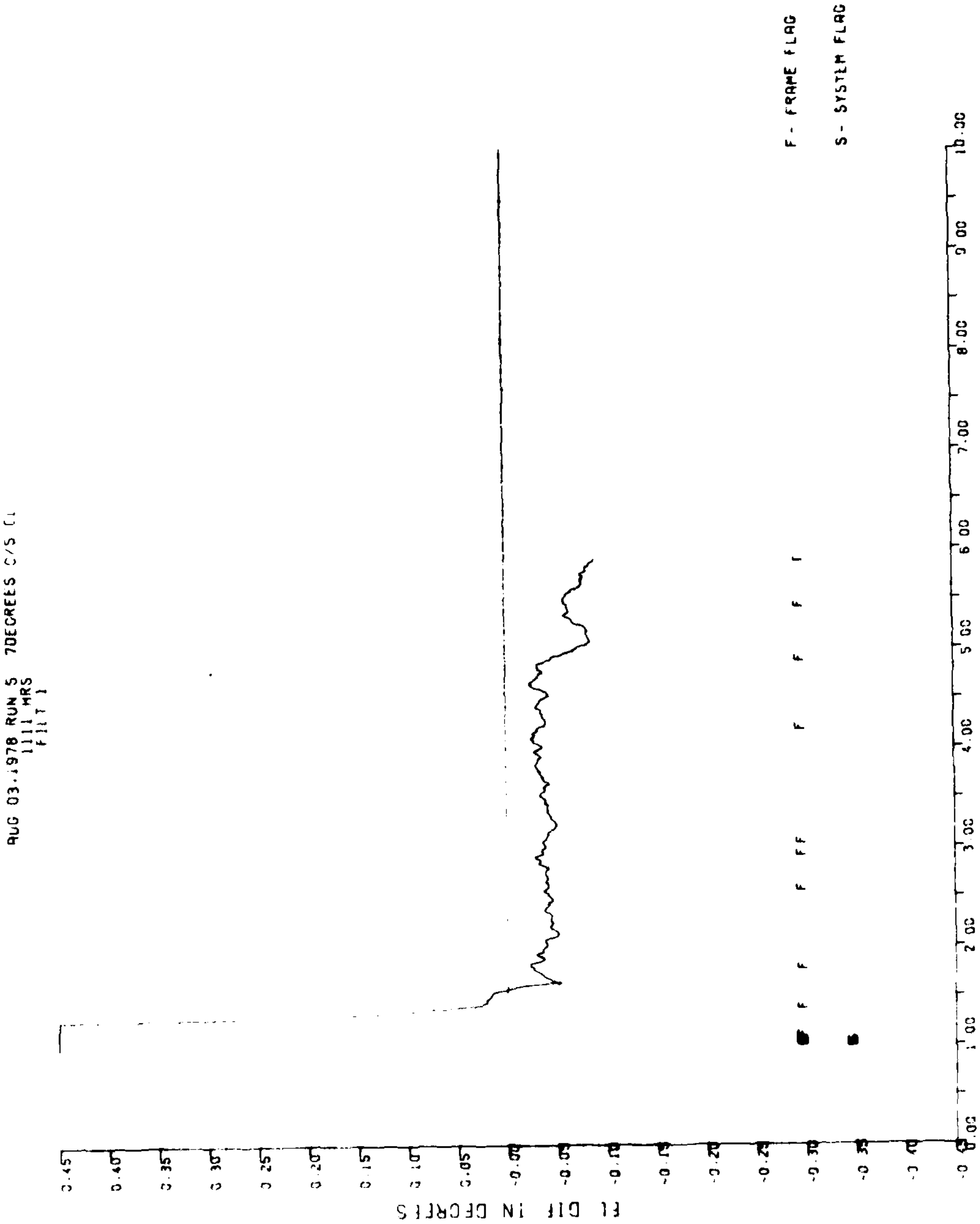

AUG 03.1978 RUN 5 7DEGREES C/S CL
1111 HRS
FILT 1
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM PHASE CENTER
AZ DIF IN DEGREES

79-34-A-50

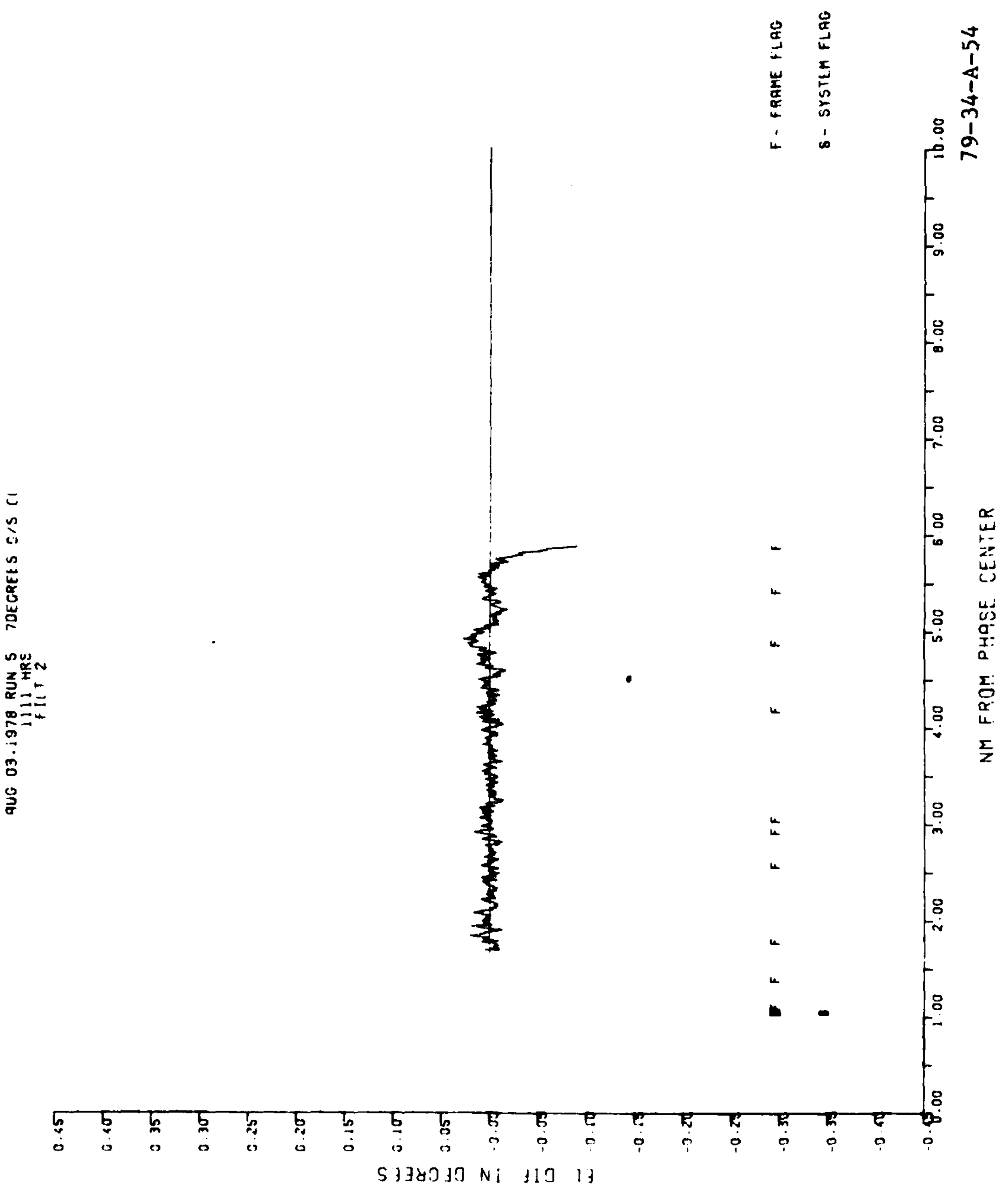

AUG 03.1978 RUN 5
F - FRAME FLAG
S - SYSTEM FLAG
FROM PHASE CENTER
79-34-A-51


AUG 03,1978 RUN 5 7DEGREES G/S CL
1111 HRS
SYS 1
EL MLS AND TRACKER
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
- - MLS
+ - TRACKER

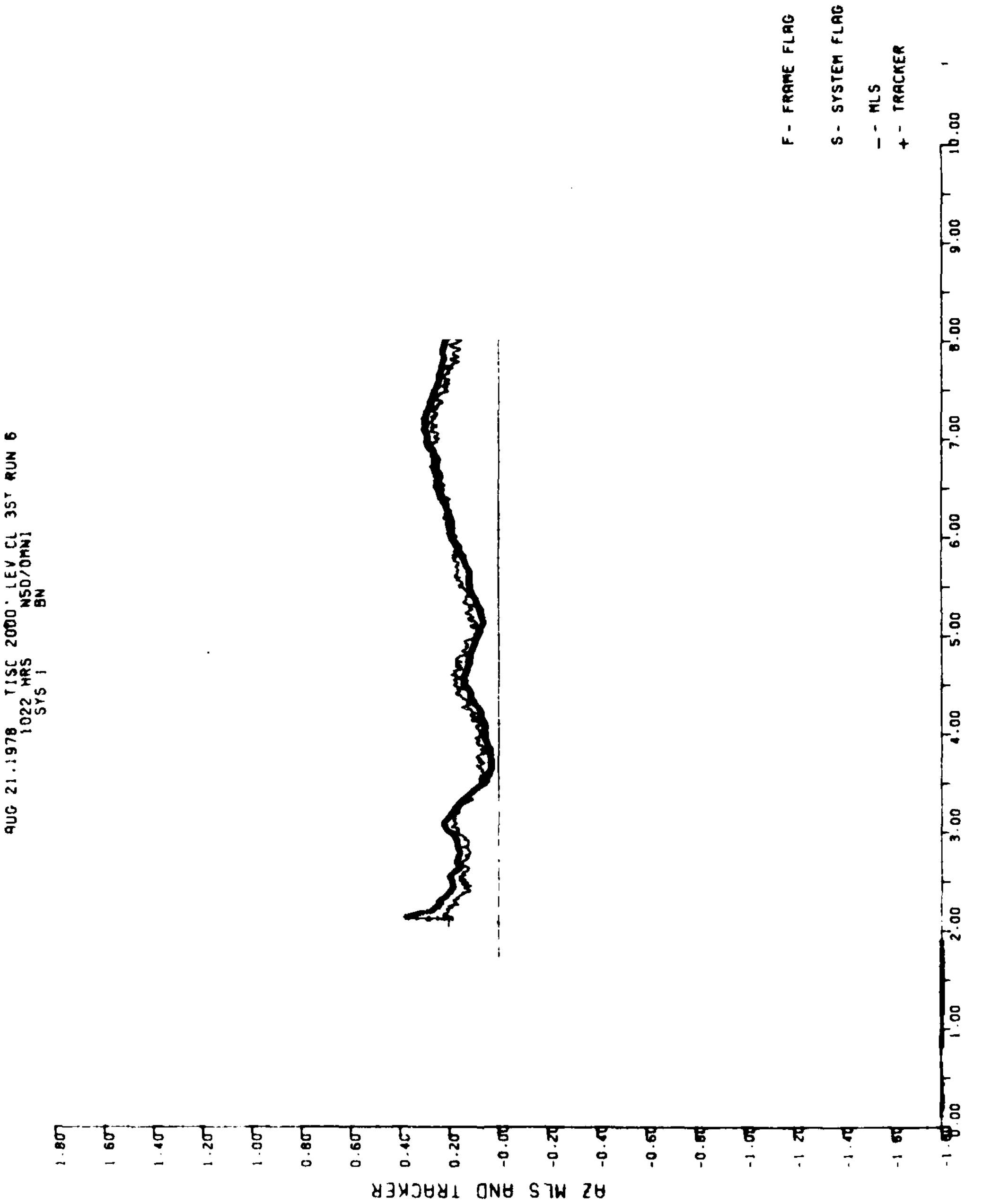
79-34-A-52


AUG 03.1978 RUN 5 7DEGREES C/S CL
1111 HRS
FILT 1
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM PHASE CENTER
EL DIF IN DEGREES

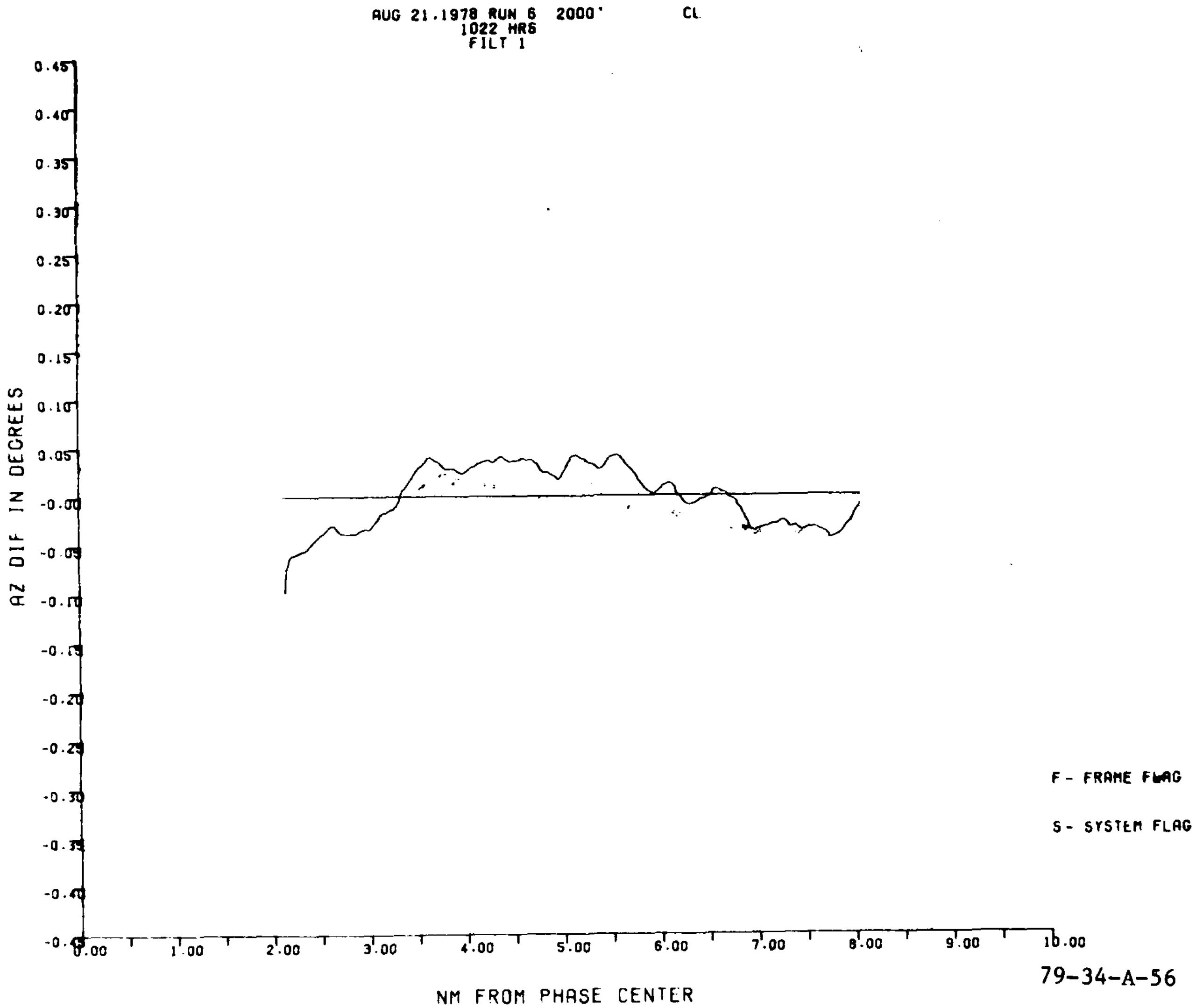
79-34-A-53


AUG 03,1978 RUN 5 7DEGREES C/S CL
1111 HRS
FILT 2
EL DIF IN DEGREES
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

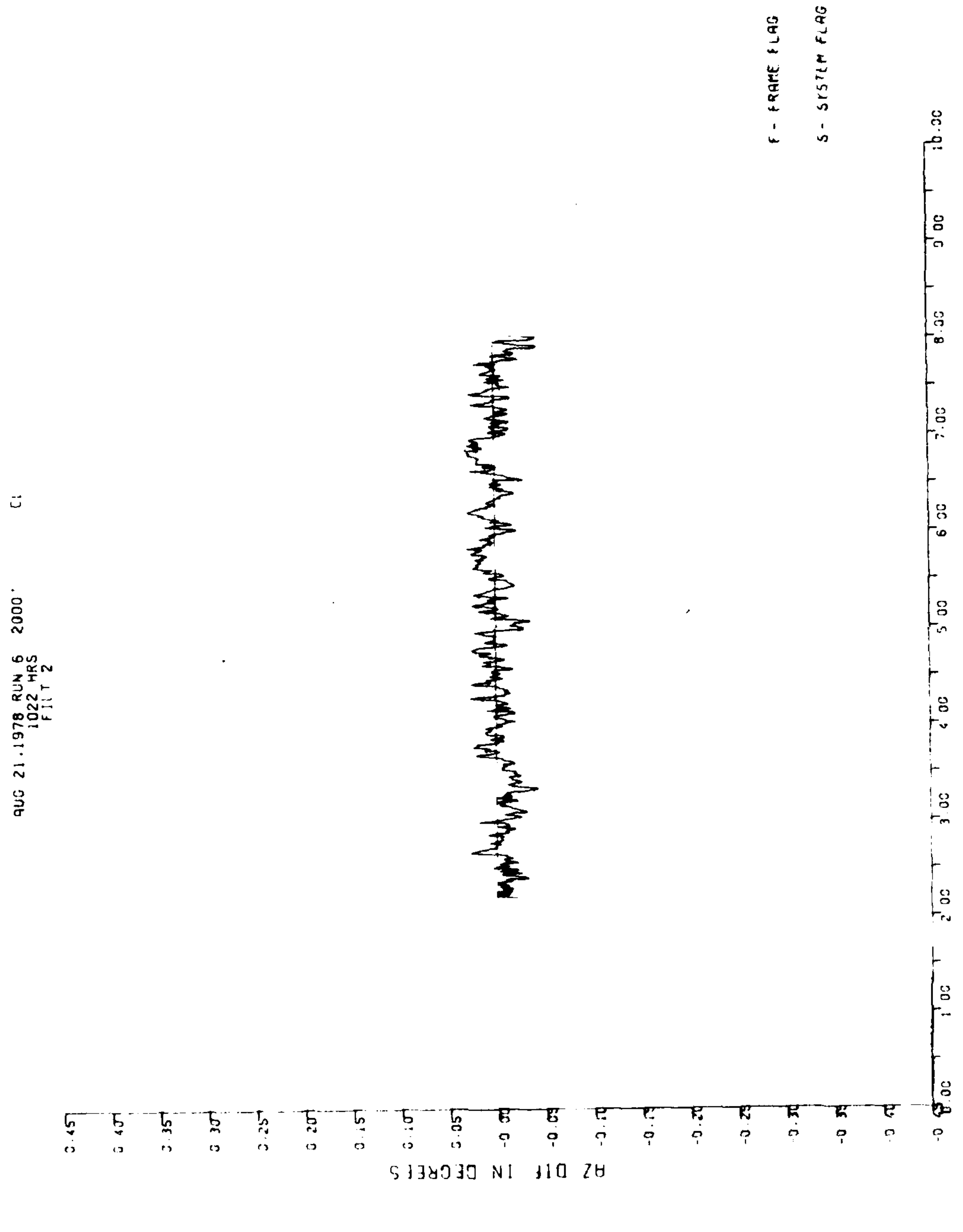
79-34-A-54


AUG 21,1978 TISC 2000' LEV CL 3ST RUN 6
1022 HRS NSD/OMNI
SYS 1 BN
AZ MLS AND TRACKER
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
— - MLS
+ - TRACKER

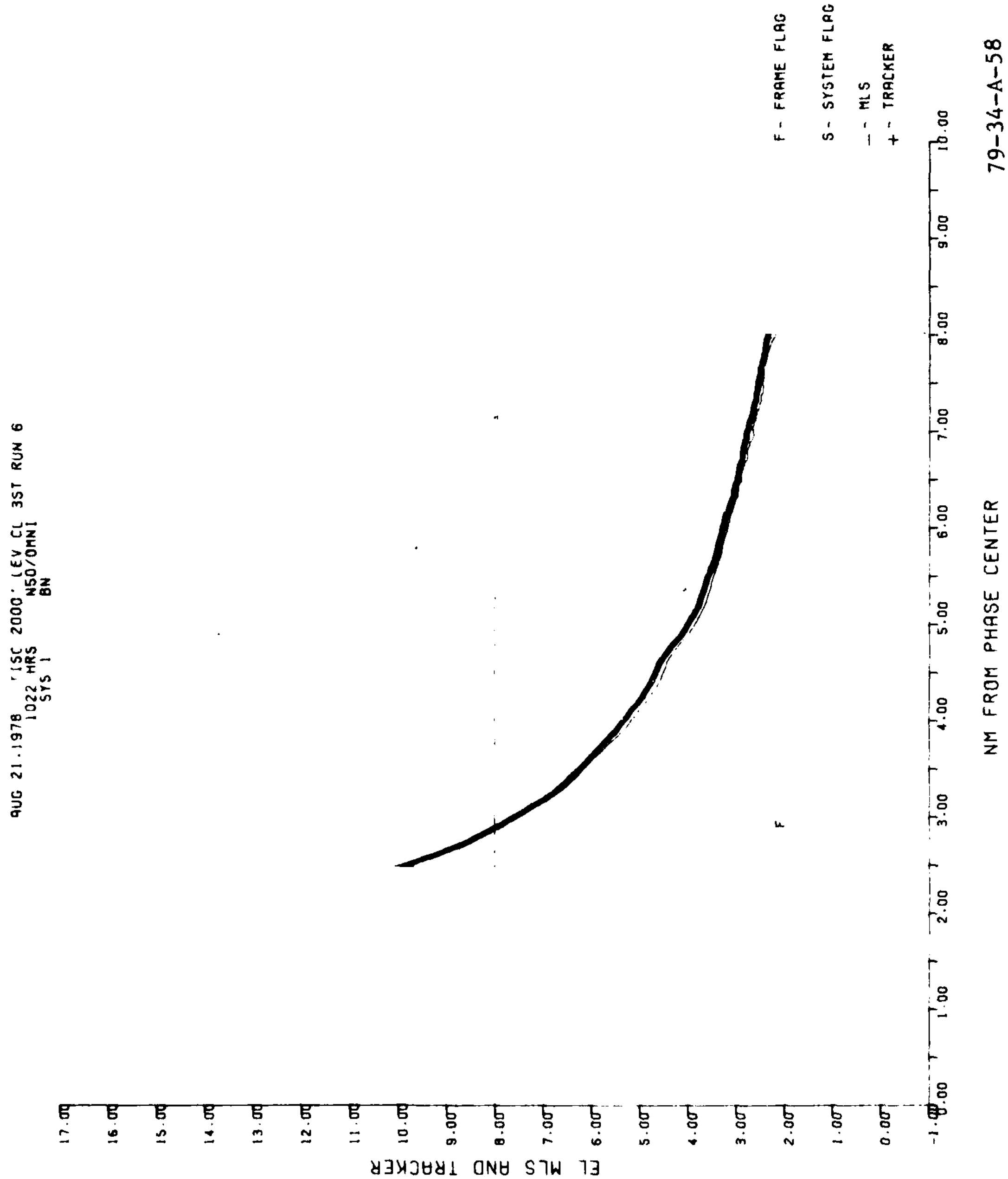
79-34-A-55

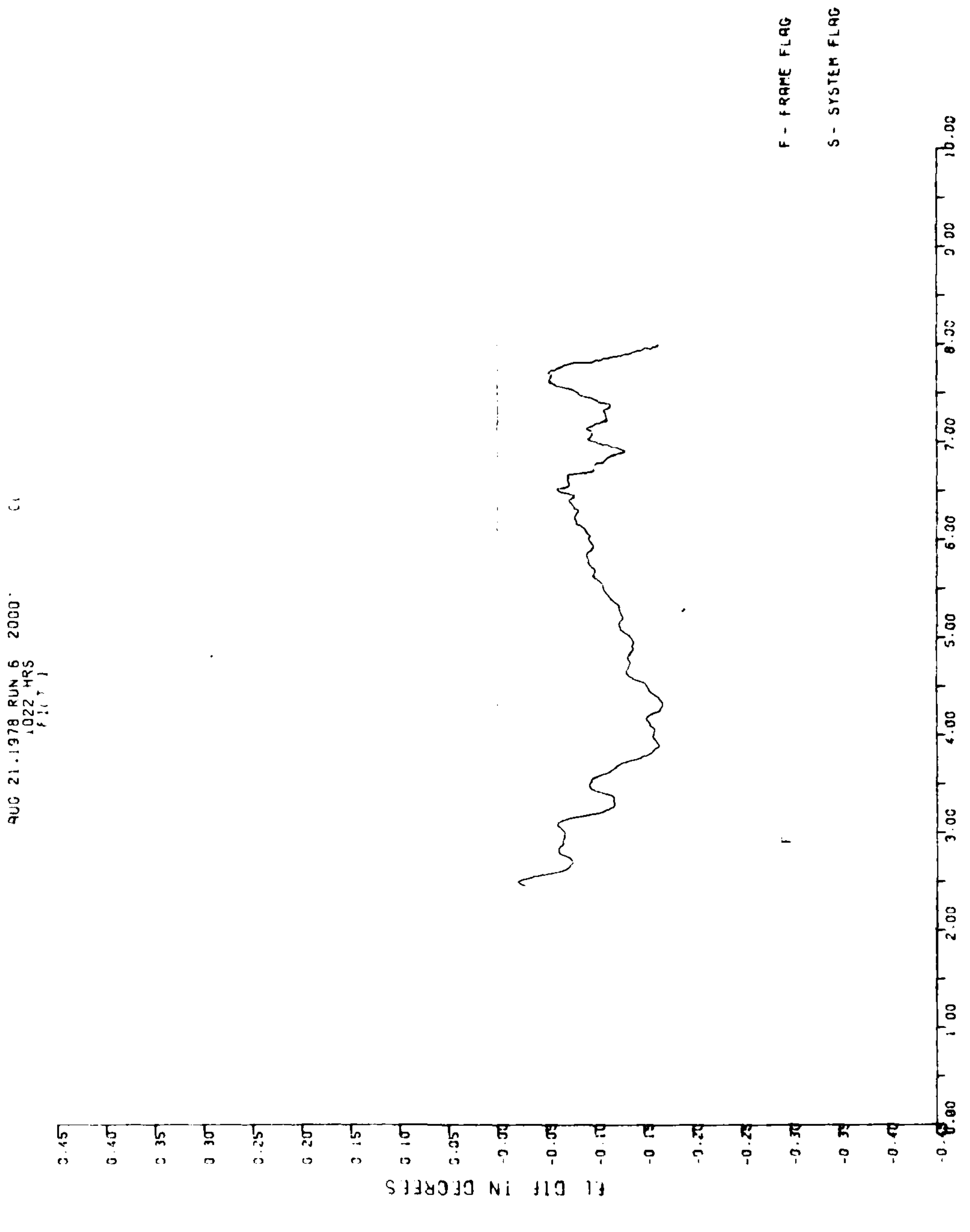

AUG 21.1978 RUN 6 2000' CL
1022 HRS
FILT 1
AZ DIF IN DEGREES
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-56


AUG 21.1978 RUN 6 2000'
1022 HRS
FILT 2
F - FRAME FLAG
S - SYSTEM FLAG
AZ DIF IN DEGREES
NM FROM PHASE CENTER
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00

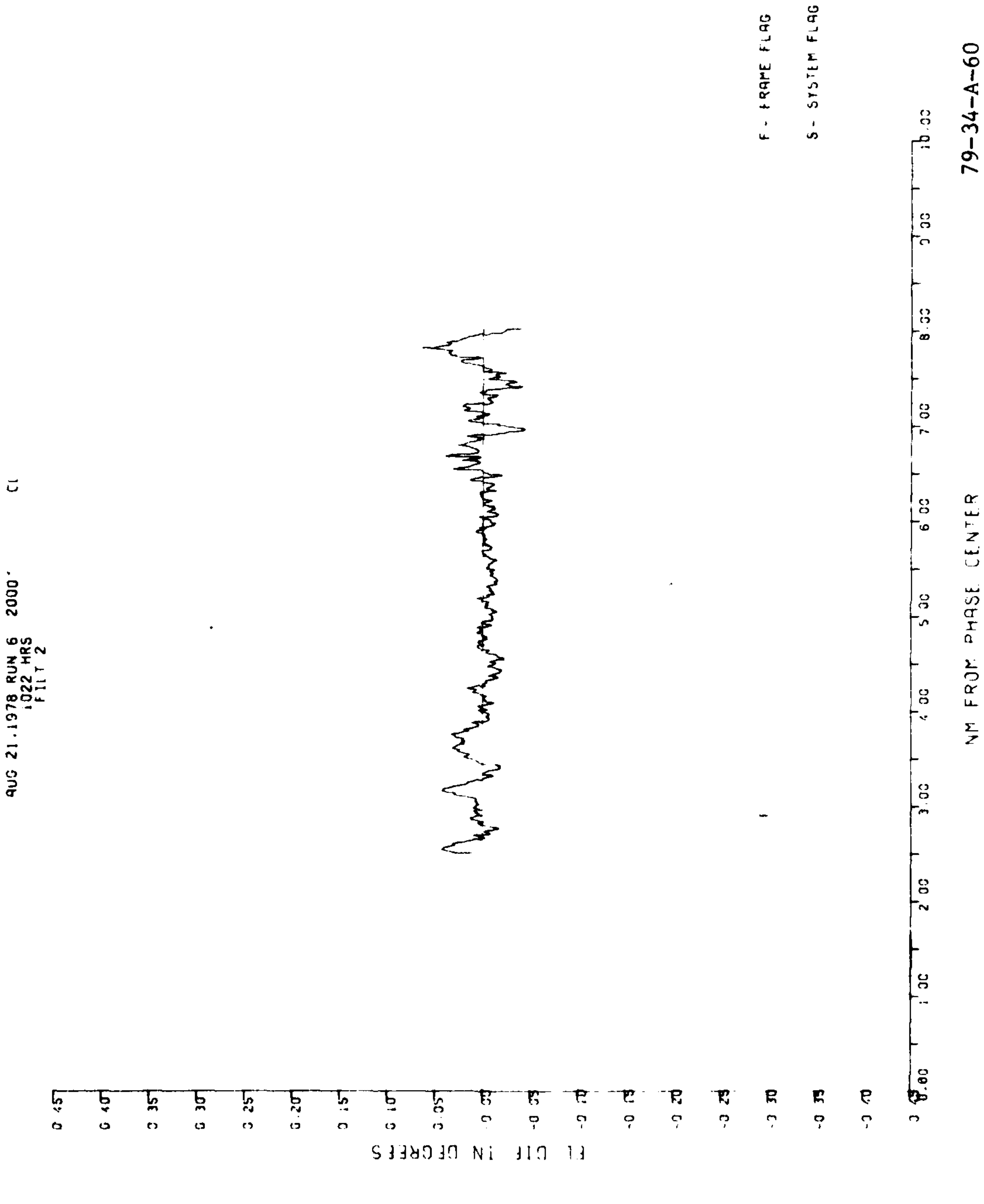
79-34-A-57


AUG 21.1978 'ISC 2000' LEV CL 3ST RUN 6
1022 HRS N50/OMNI
SYS 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
- MLS
+ - TRACKER
NM FROM PHASE CENTER
EL MLS AND TRACKER
79-34-A-58

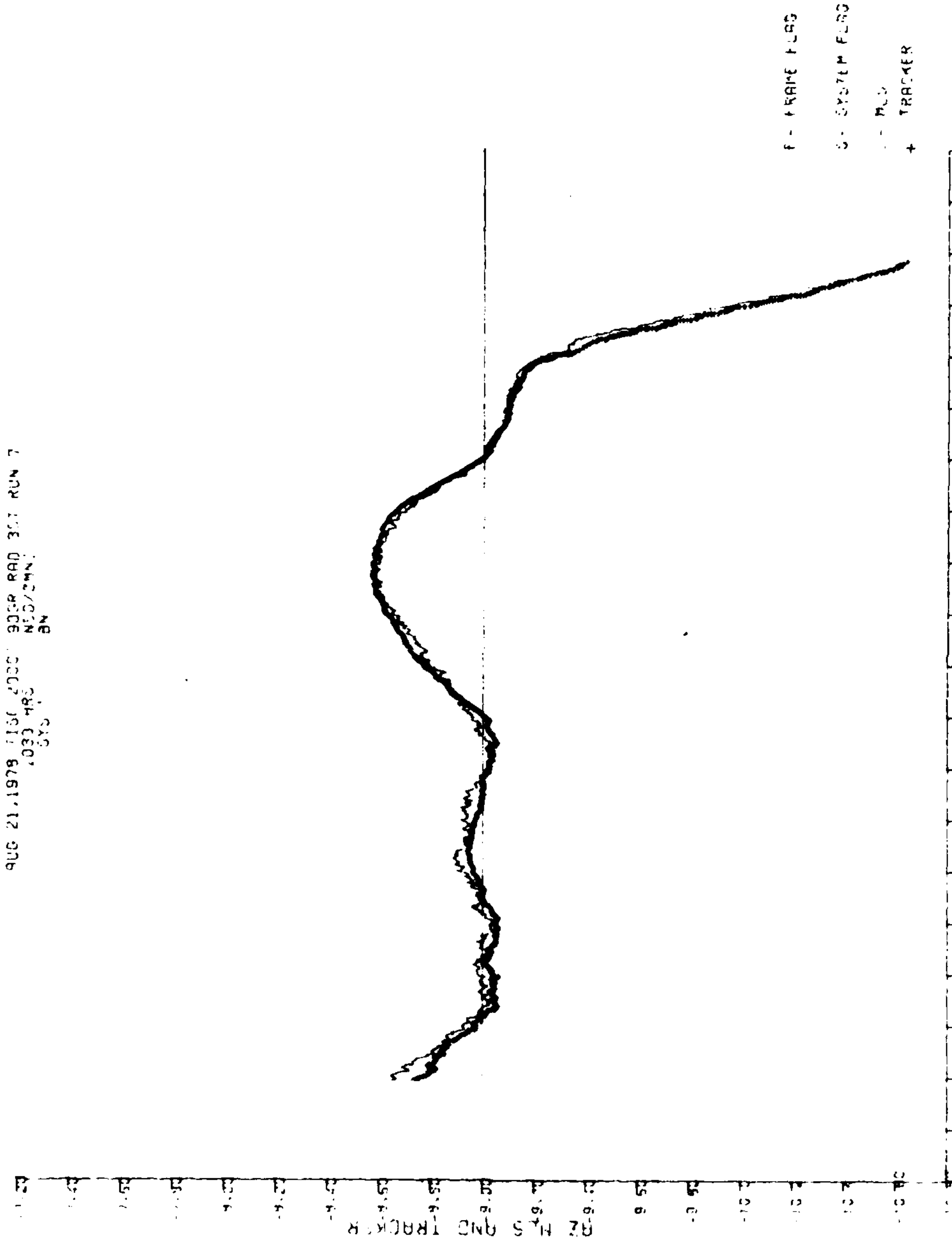


AUG 21,1978 RUN 6 2000'
1022 HRS
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM PHASE CENTER
EL DIF IN DEGREES

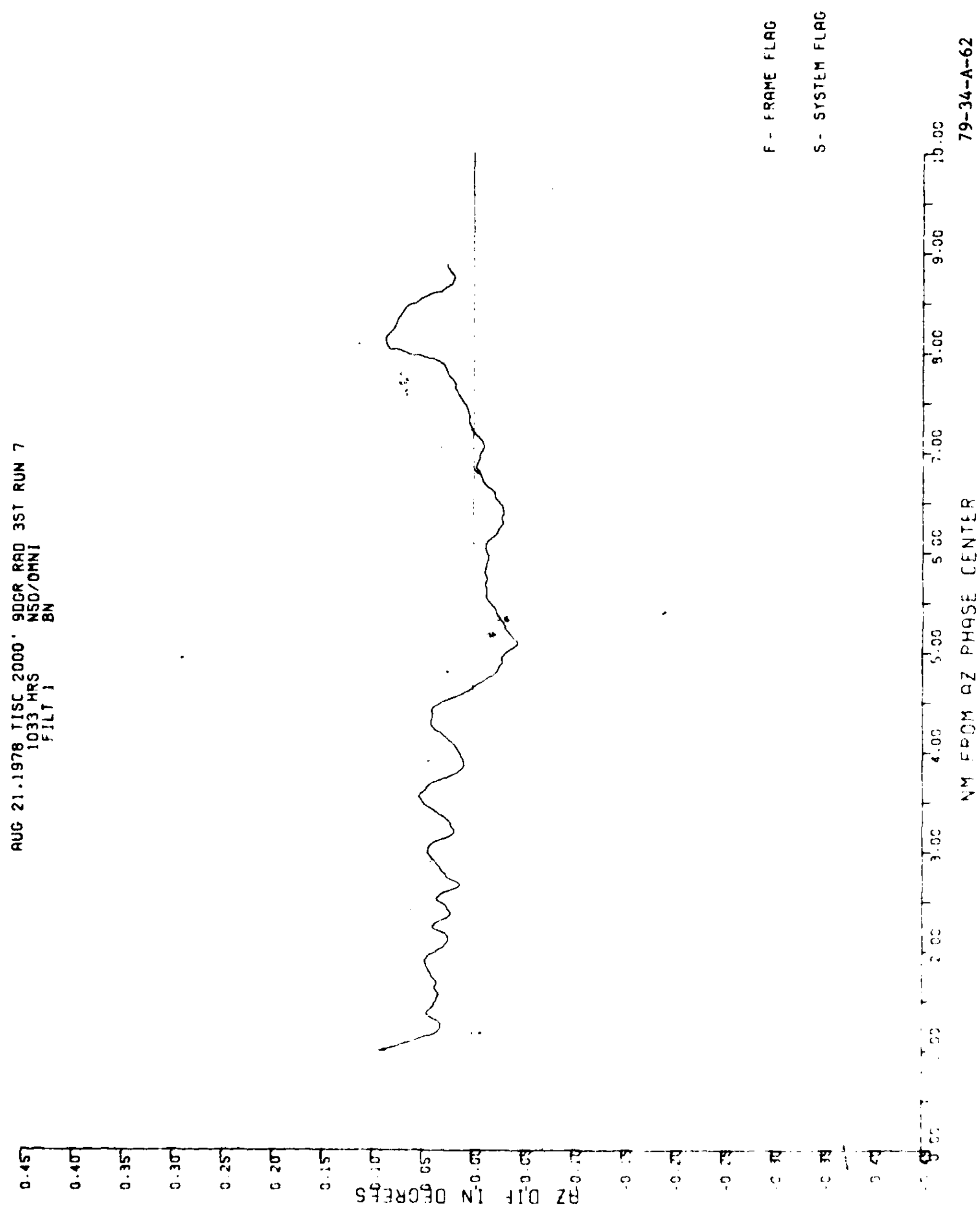
79-34-A-59

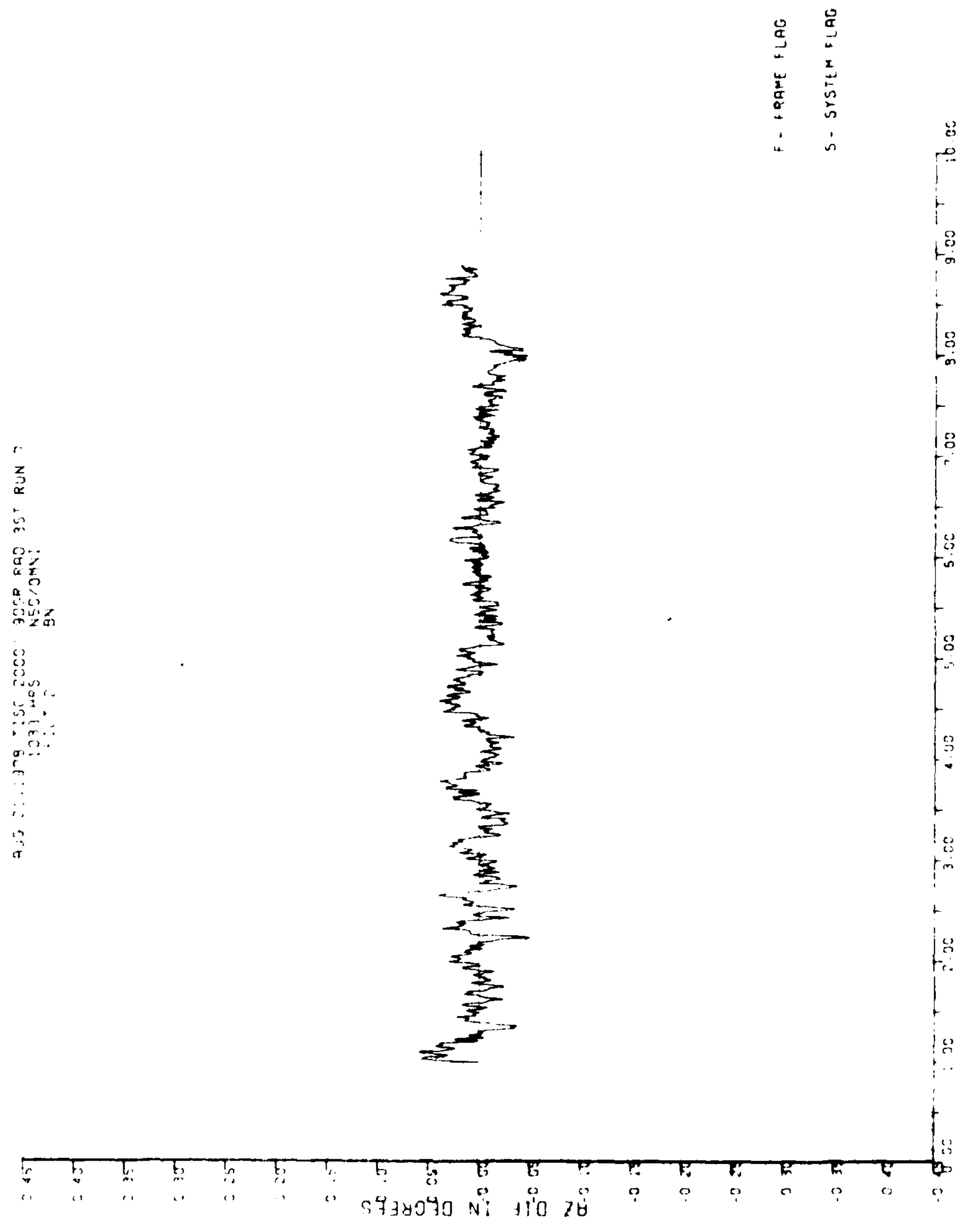


AUG 21,1978 RUN 6 2000'
1022 HRS
FILT 2
CL
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM PHASE CENTER
EL DIF IN DEGREES
79-34-A-60

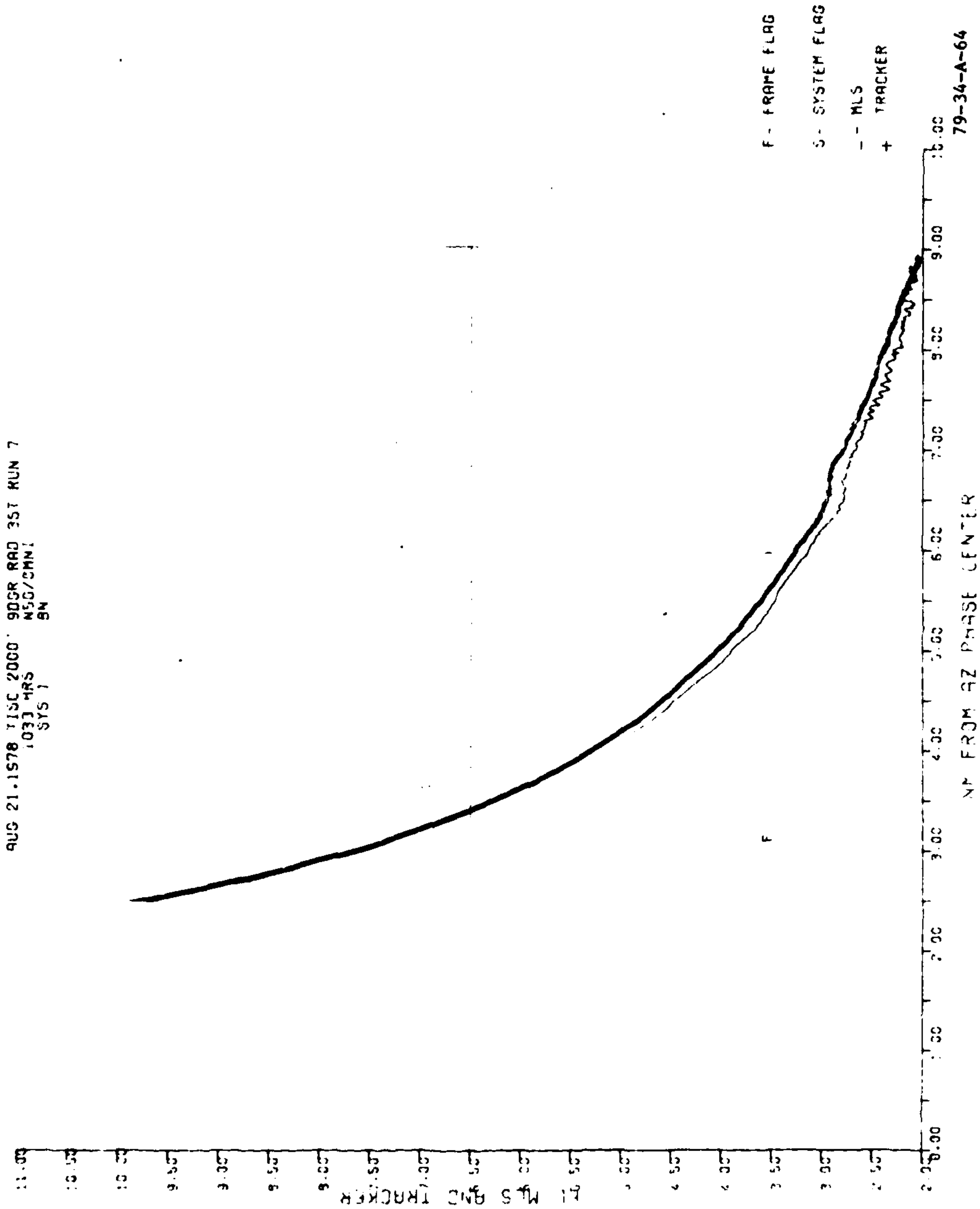


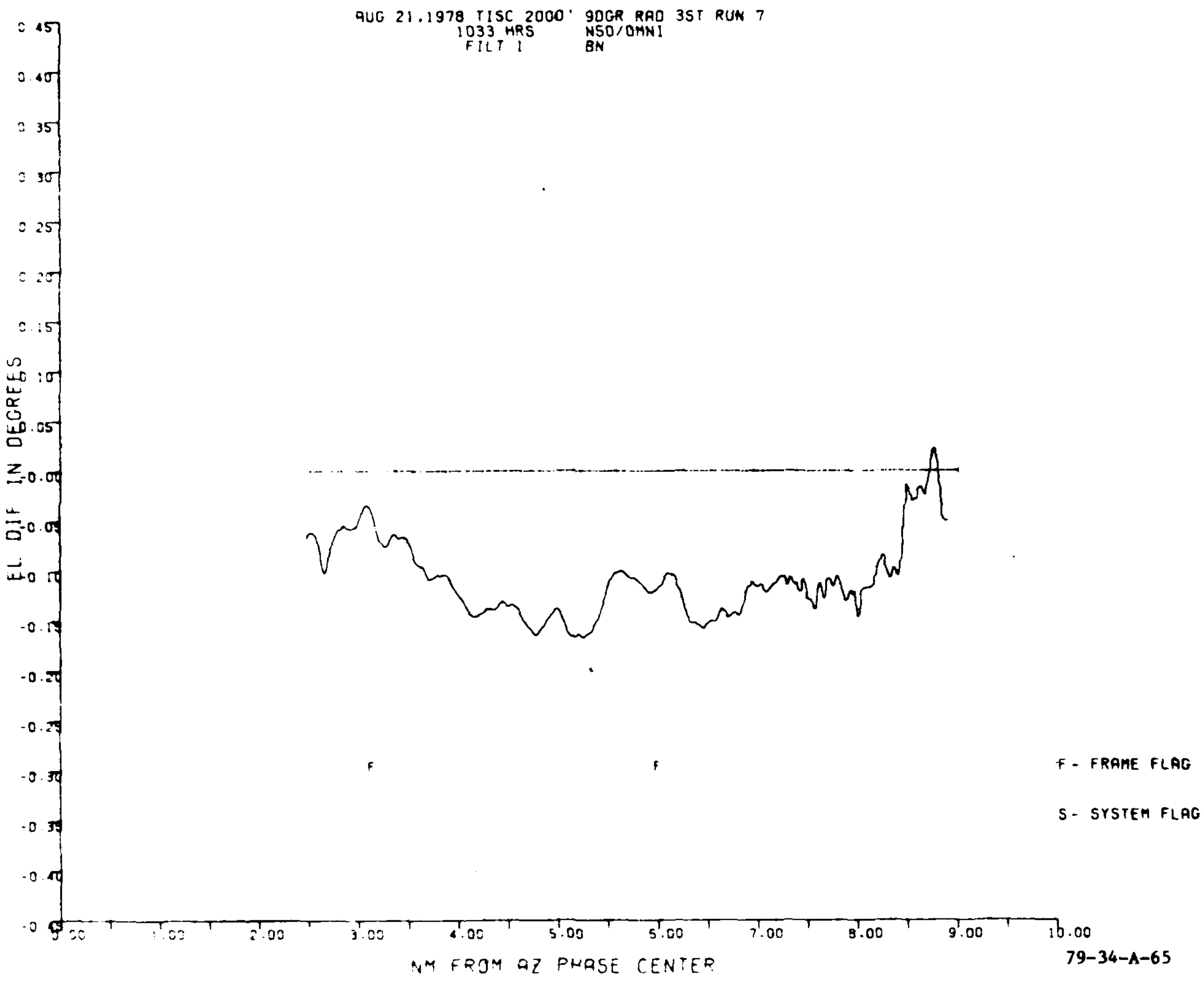
79-34-A-61


AUG 21.1978 TISC 2000' 9DGR RAD 3ST RUN 7
1033 HRS N5D/OMNI
FILT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-62
NM FROM AZ PHASE CENTER
AZ DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
10.00
9.00
8.00
7.00
5.00
4.00

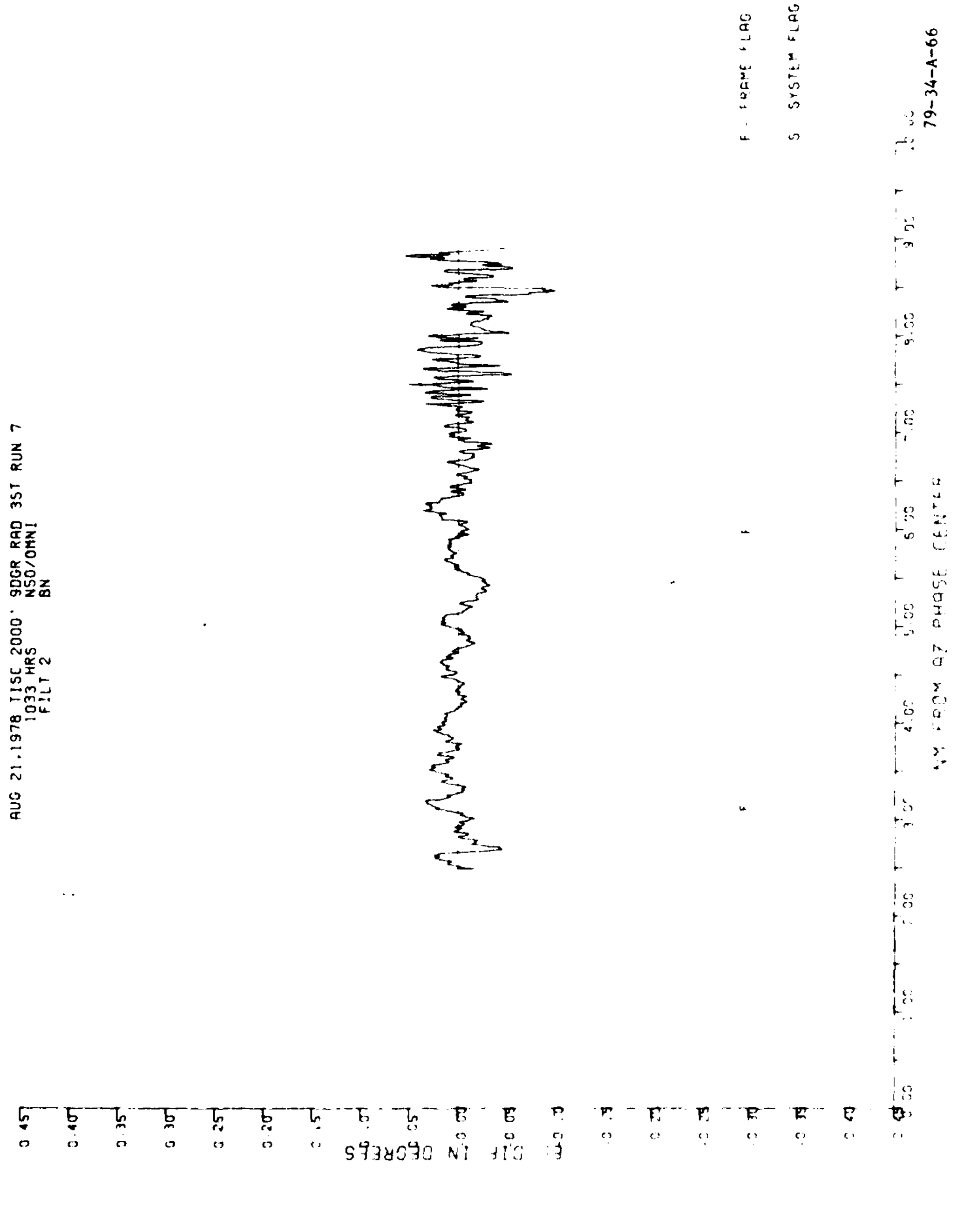

F - FRAME FLAG
S - SYSTEM FLAG
NM FROM AZ PHASE CENTER
AZ DIF IN DEGREES

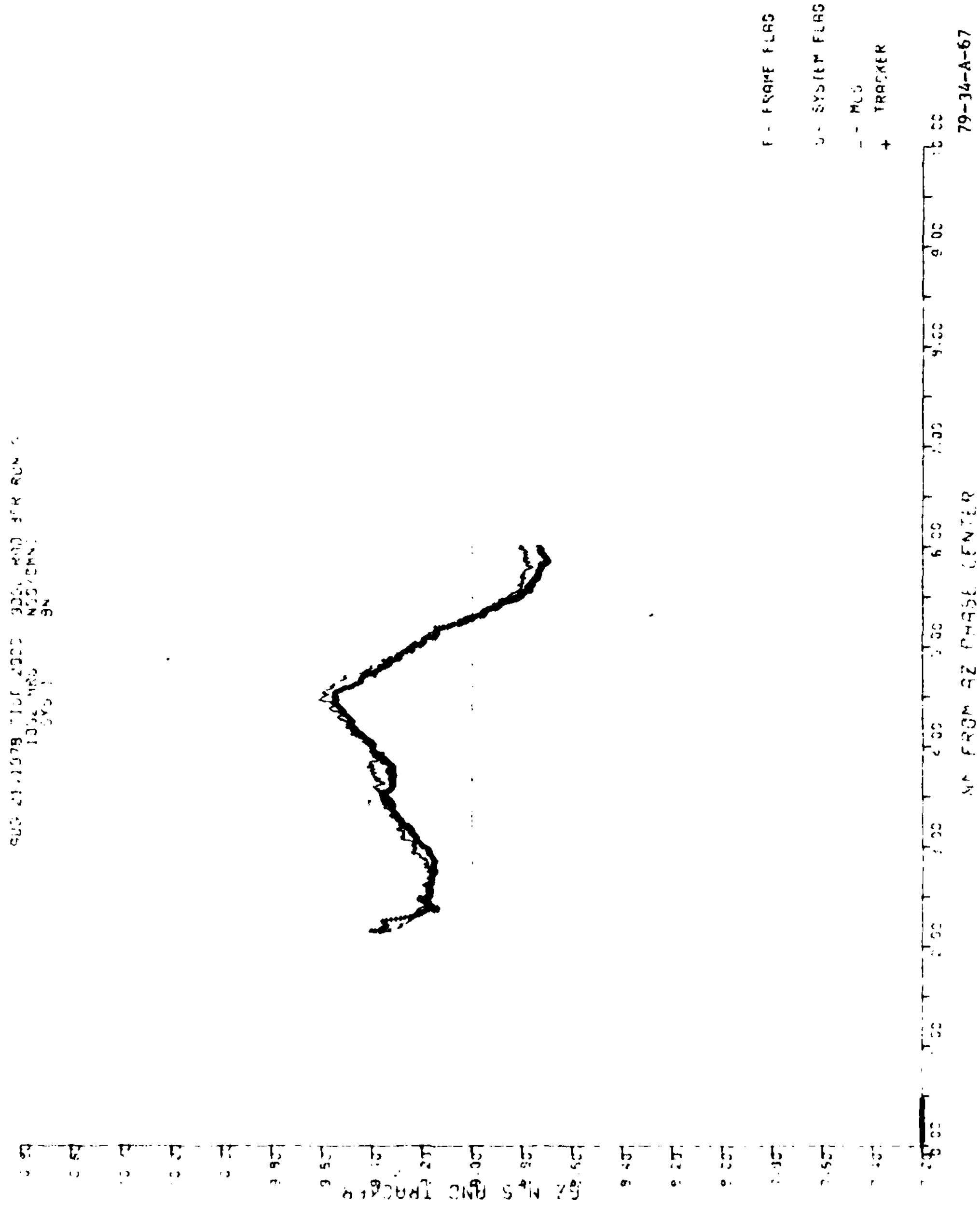
79-34-A-63

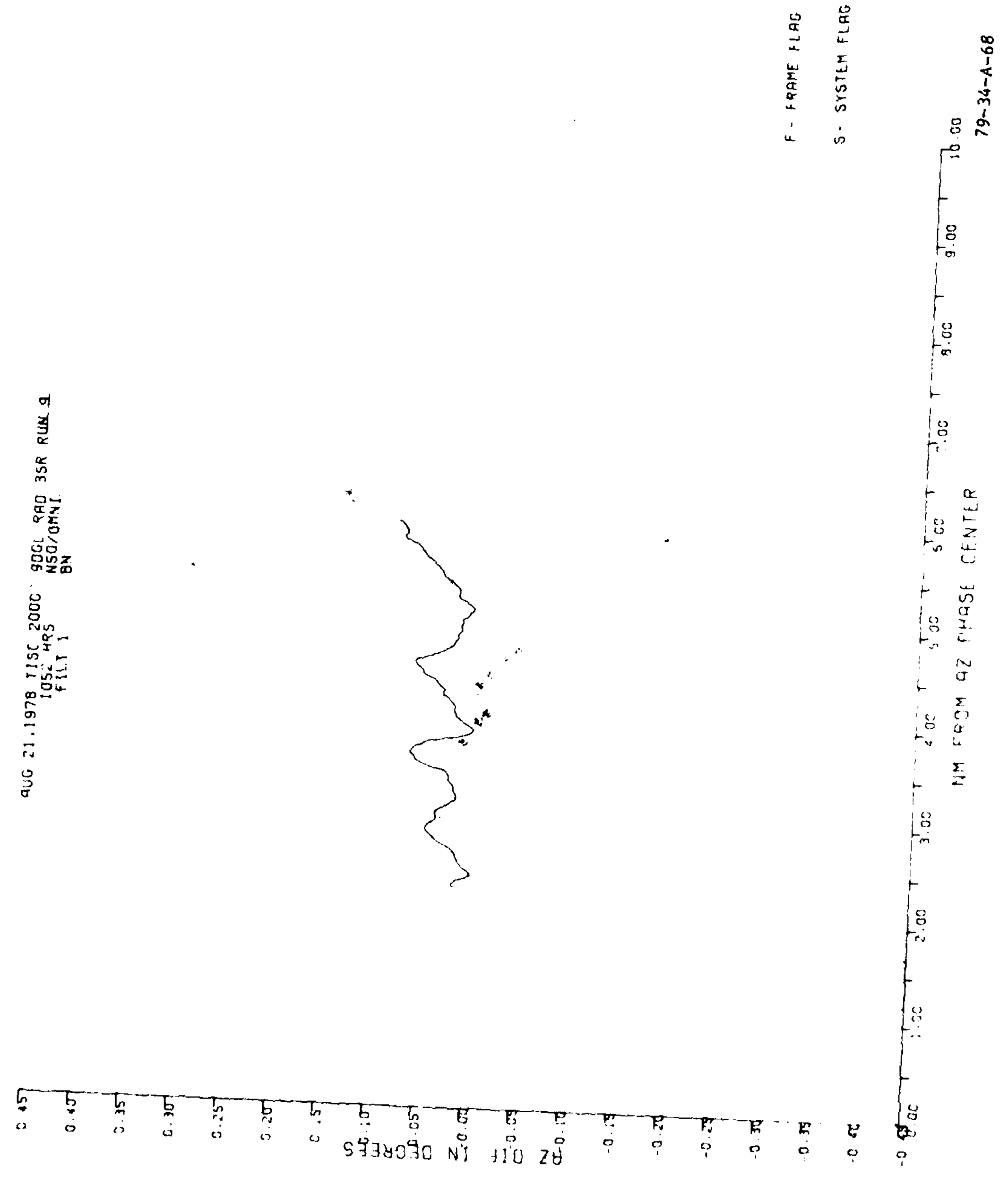

AUG 21.1978 TISC 2000' 90GR RAD 35T RUN 7
1033 HRS NSO/OMNI
SYS 1 8N
EL MLS AND TRACKER
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
_ - MLS
+ TRACKER
79-34-A-64

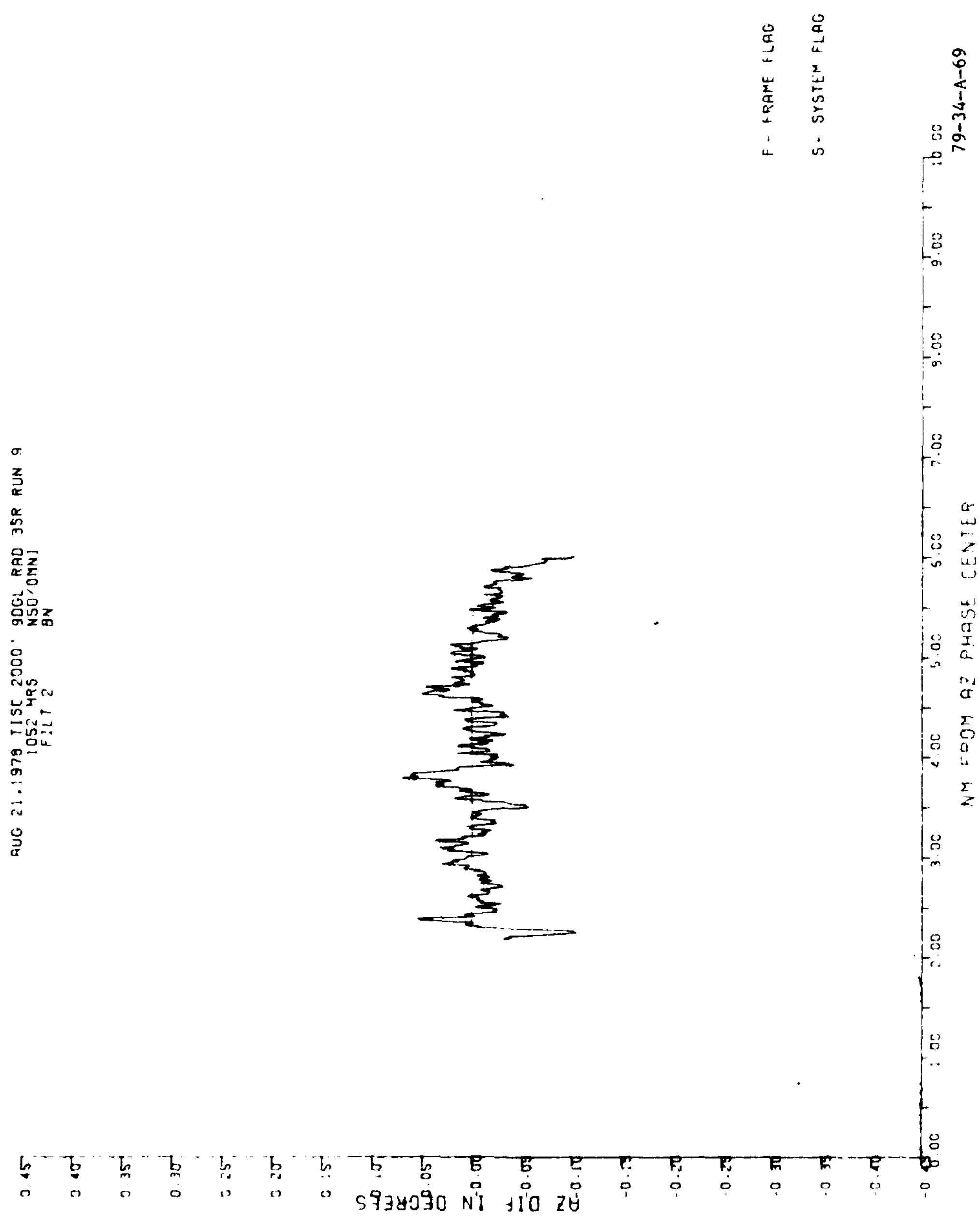

AUG 21.1978 TISC 2000' 9DGR RAD 3ST RUN 7
1033 HRS NSO/OMNI
FILT 1 BN
EL DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00

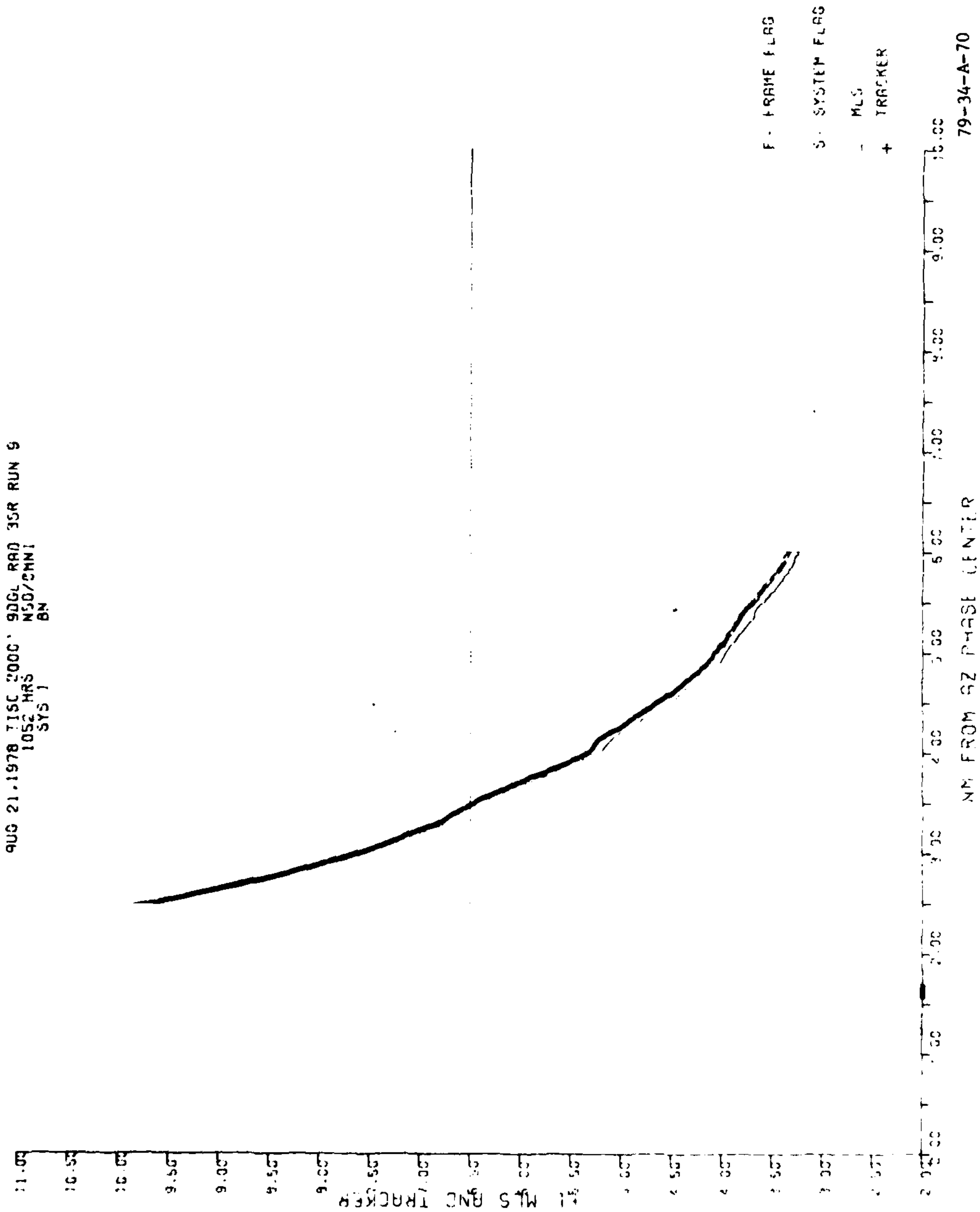
79-34-A-65


AUG 21.1978 TISC 2000' 9DGR RAD 3ST RUN 7
1033 HRS
NSO/OMNI
FILT 2
BN
F FRAME FLAG
S SYSTEM FLAG
79-34-A-66
KM FROM Q7 PHASE CENTER
DIF IN DEGREES

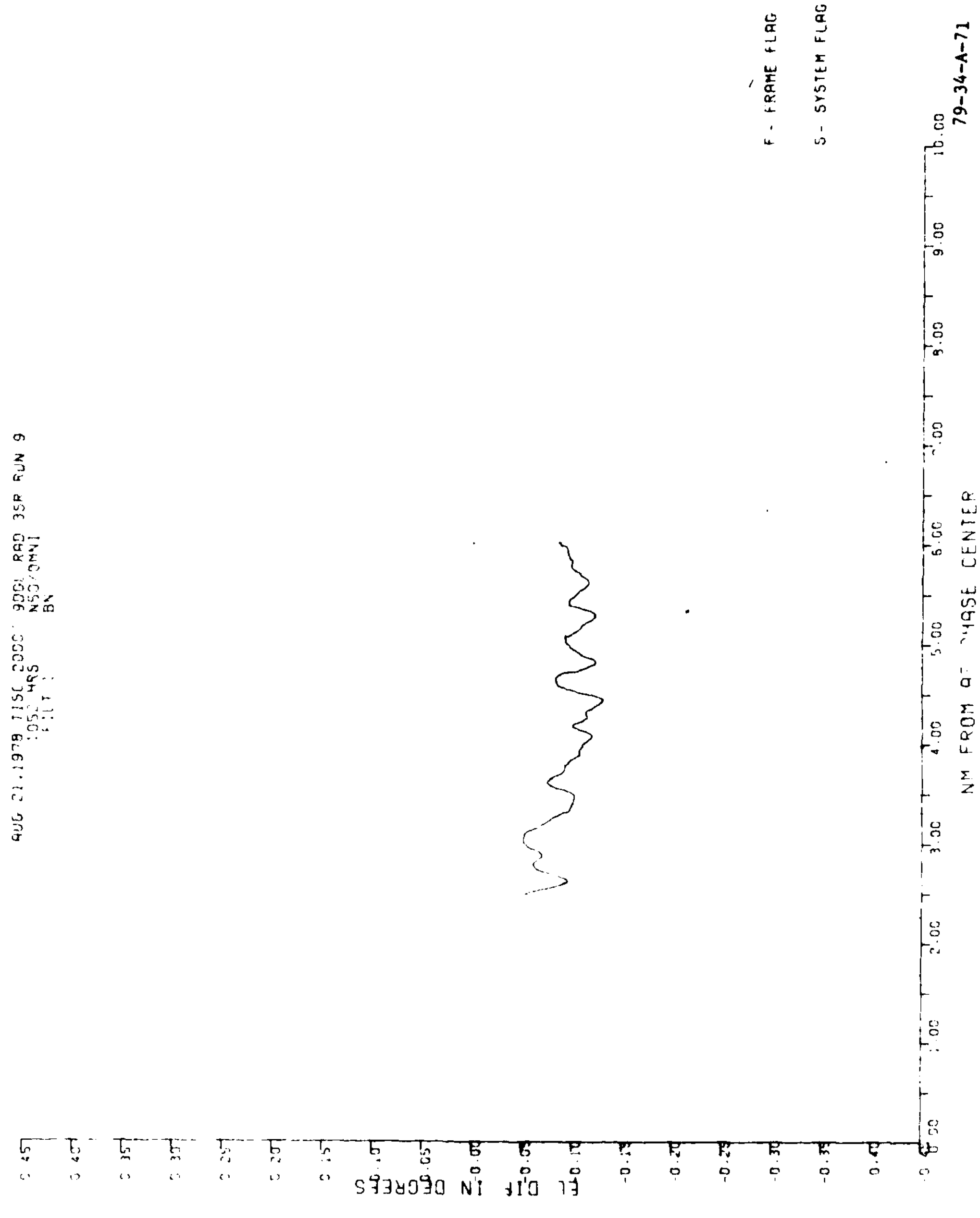

F - FRAME FLAG
S - SYSTEM FLAG
TRACKER
79-34-A-67


AUG 21.1978 TISC 2000 90GL RAD 35R RUN 9
1052 HRS NSO/OMNI
FILT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM AZ PHASE CENTER
AZ DIF IN DEGREES
79-34-A-68


AUG 21,1978 TISC 2000' 9DGL RAD 35R RUN 9
1052 HRS NSO/OMNI
FILT 2 BN
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM AZ PHASE CENTER
AZ DIF IN DEGREES
79-34-A-69


AUG 21,1978 TISC 2000' 9DGL RAD 35R RUN 9
1052 HRS
SYS 1
N50/OMNI
8N
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
- MLS
+ TRACKER

79-34-A-70


F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-71
EL DIF IN DEGREES

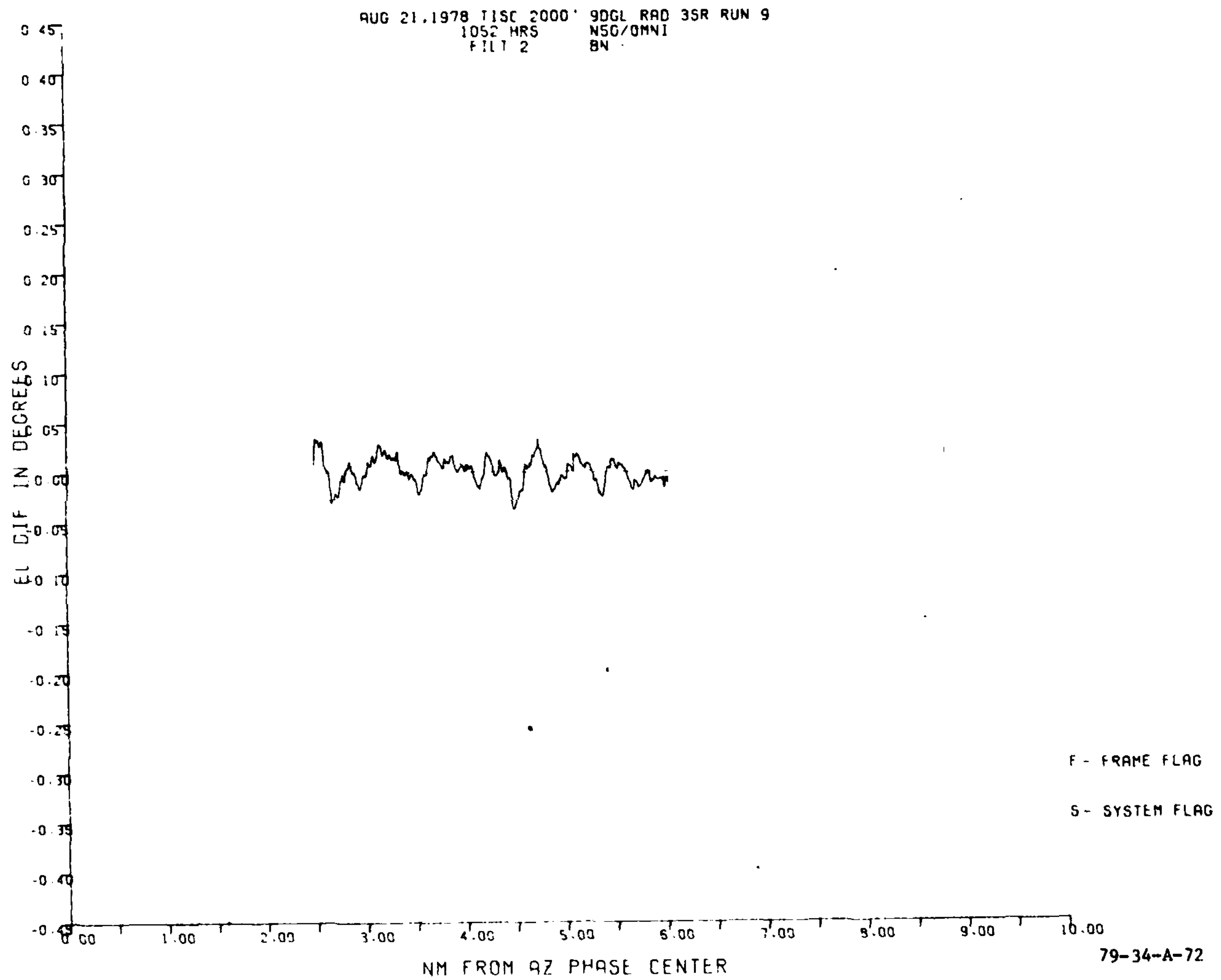
AD-A088 852 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 17/7
TEST AND EVALUATION OF TEXAS INSTRUMENTS SMALL COMMUNITY MICROW--ETC(U)
MAY 80 J WARREN

UNCLASSIFIED FAA-NA-79-34 FAA-RD-80-49 NL

2 OF 2

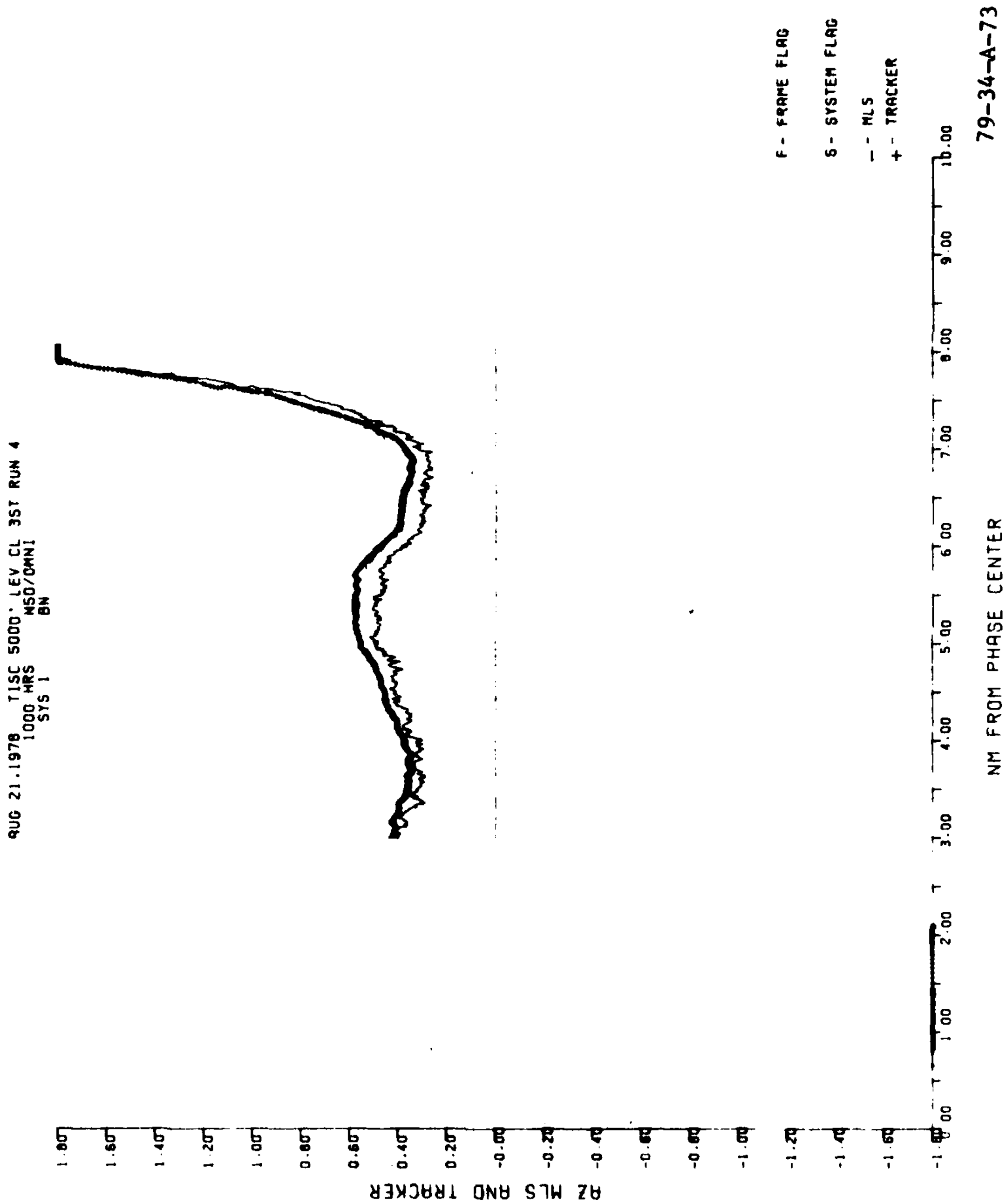
AD A088852

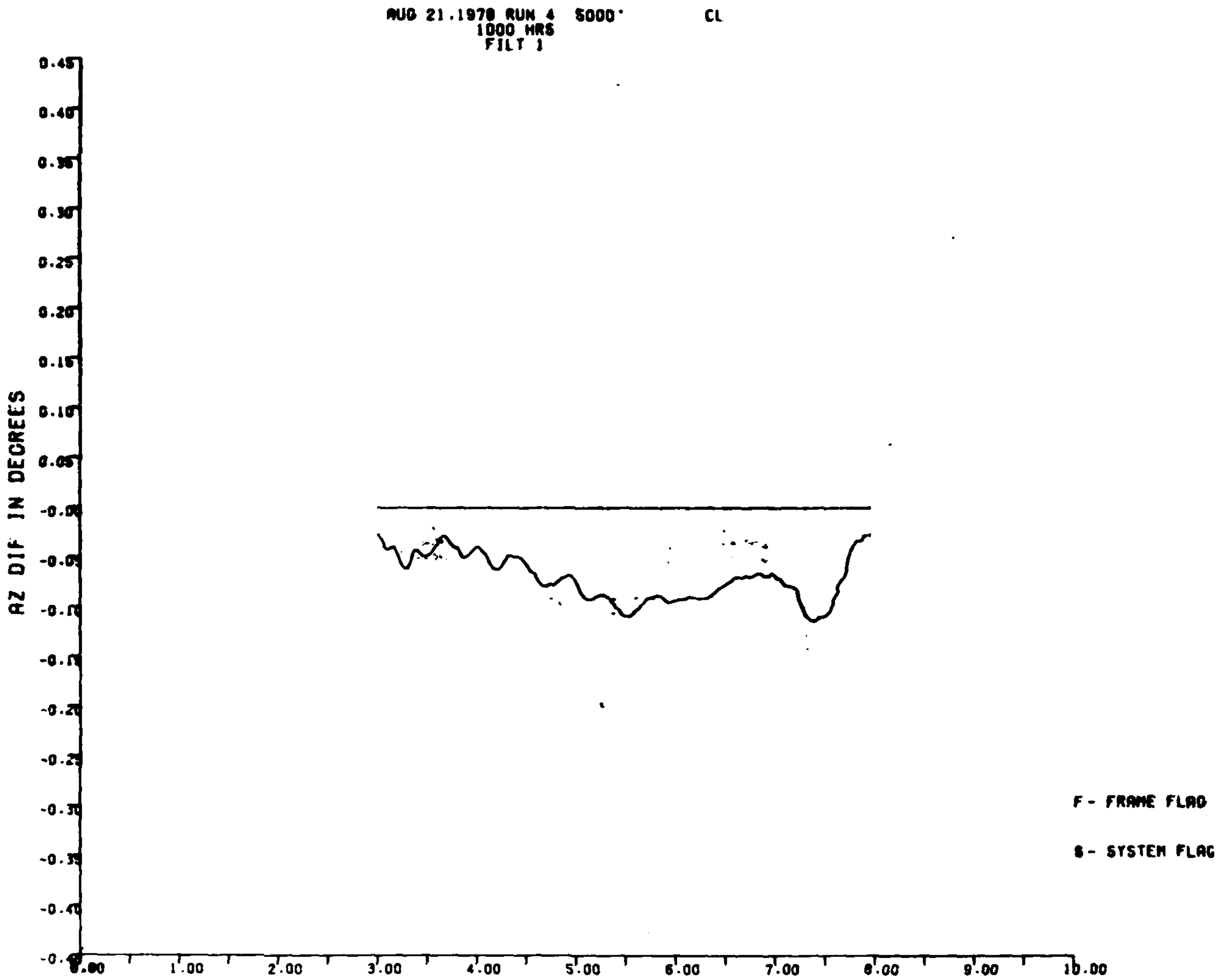
END
DATE
FILMED
10-80
DTIC



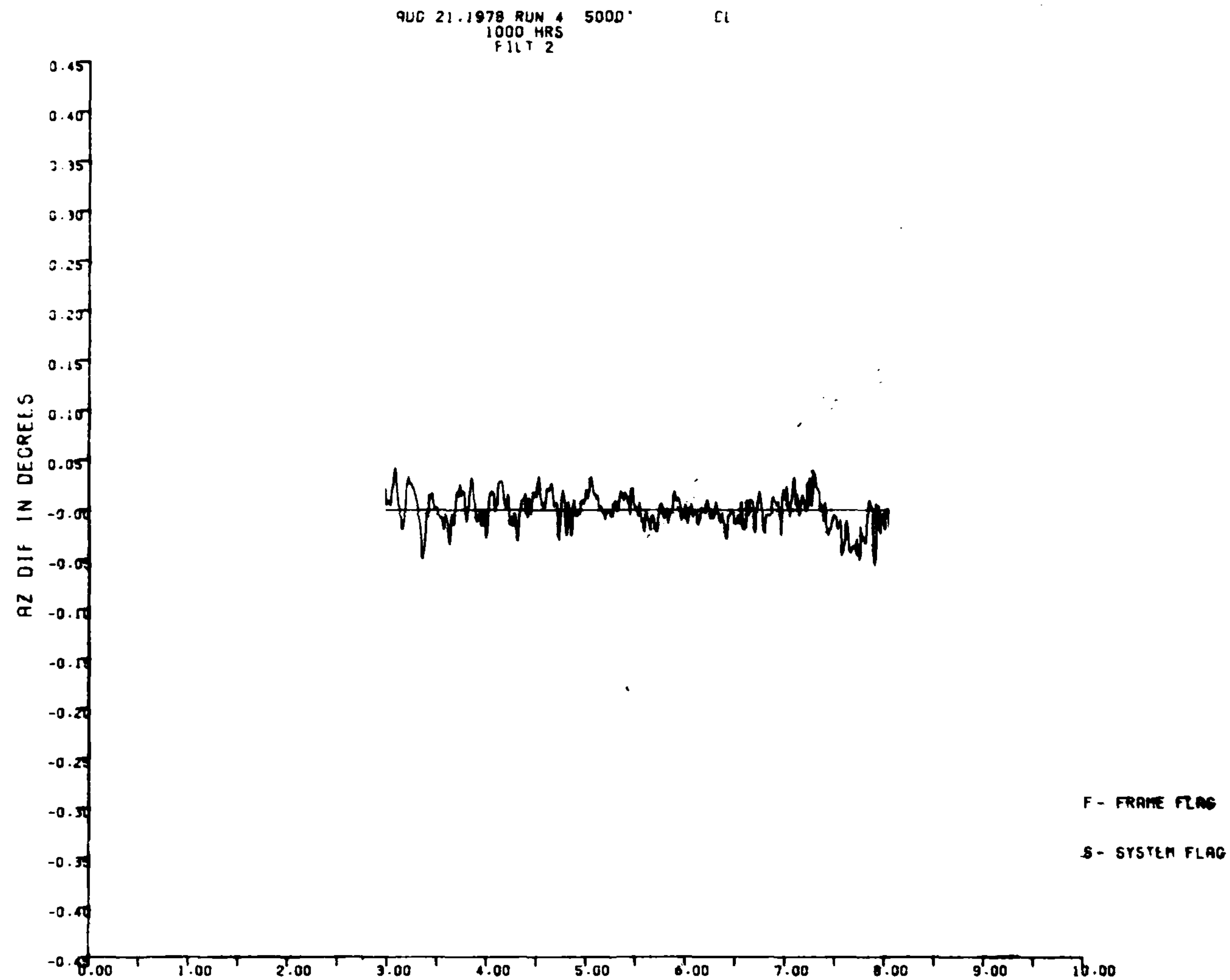
AUG 21,1978 TISC 2000' 9DGL RAD 3SR RUN 9
1052 HRS NSO/OMNI
FILT 2 8N
EL DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-72

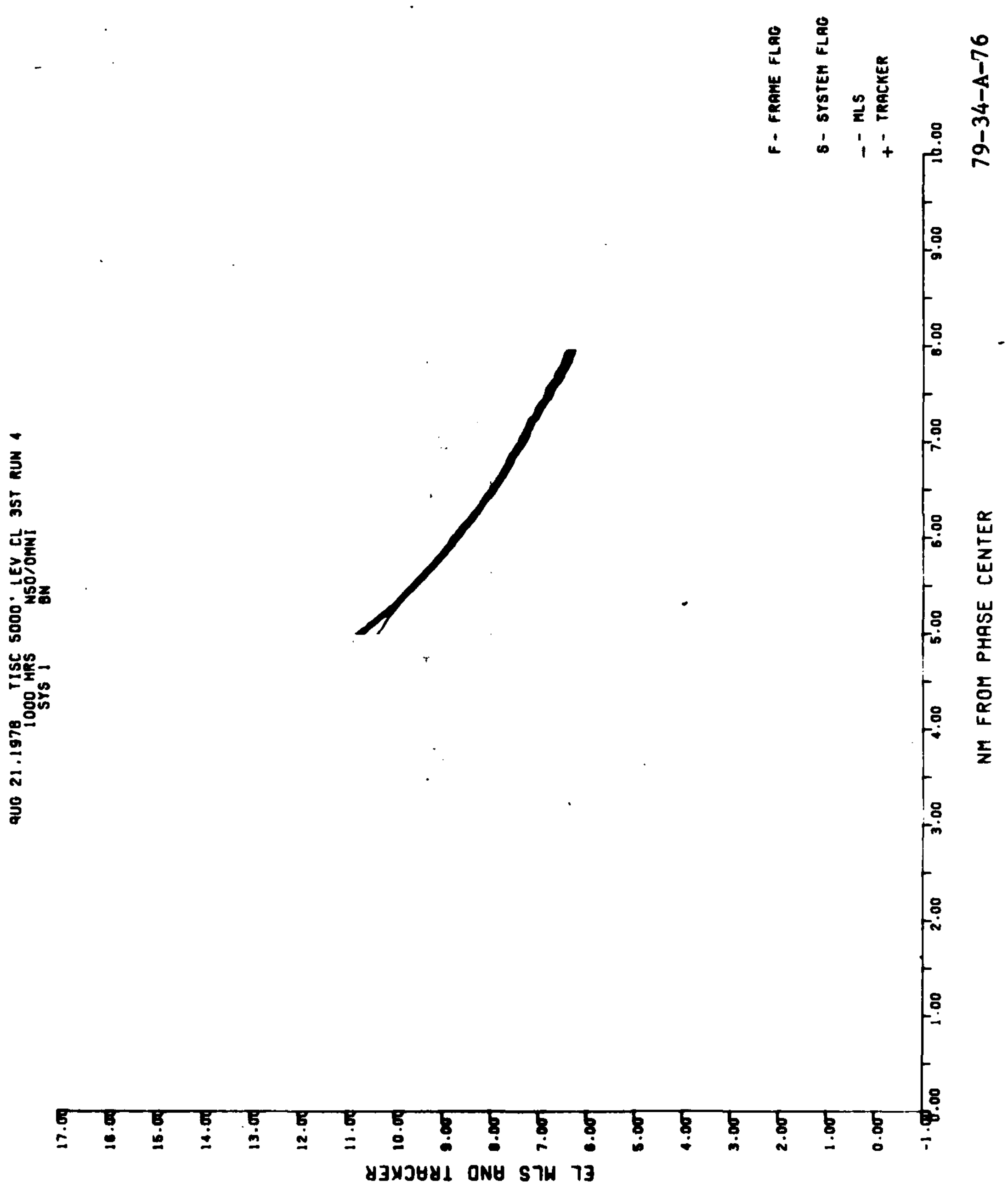

AUG 21,1978 TISC 5000' LEV CL 3ST RUN 4
1000 HRS NSO/OMNI
SYS 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
- - MLS
+ - TRACKER
AZ MLS AND TRACKER
NM FROM PHASE CENTER
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
79-34-A-73

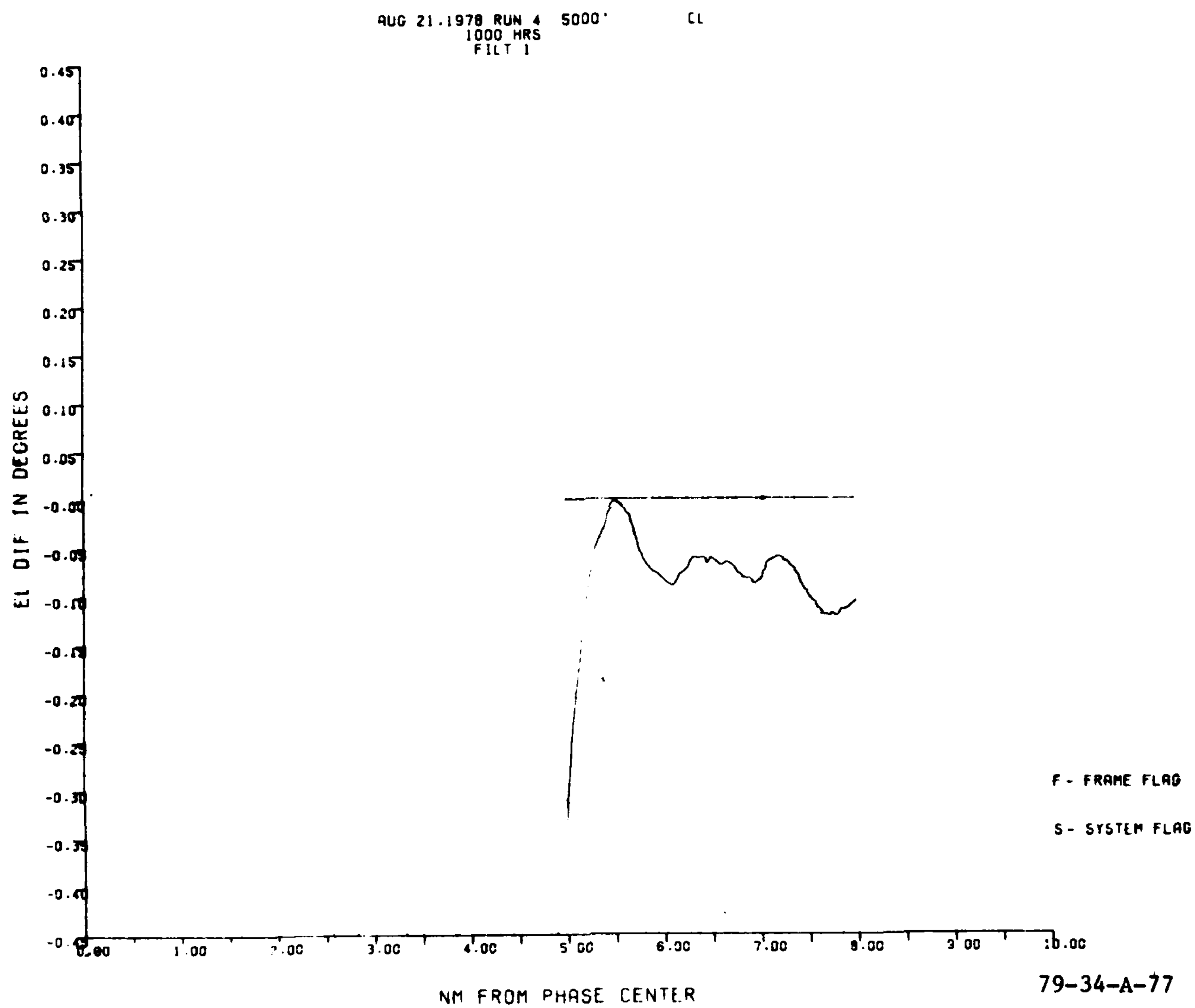

AUG 21.1978 RUN 4 5000' CL
1000 HRS
FILT 1
AZ DIF IN DEGREES
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-74


AUG 21.1978 RUN 4 5000' CL
1000 HRS
FILT 2
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
AZ DIF IN DEGREES
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

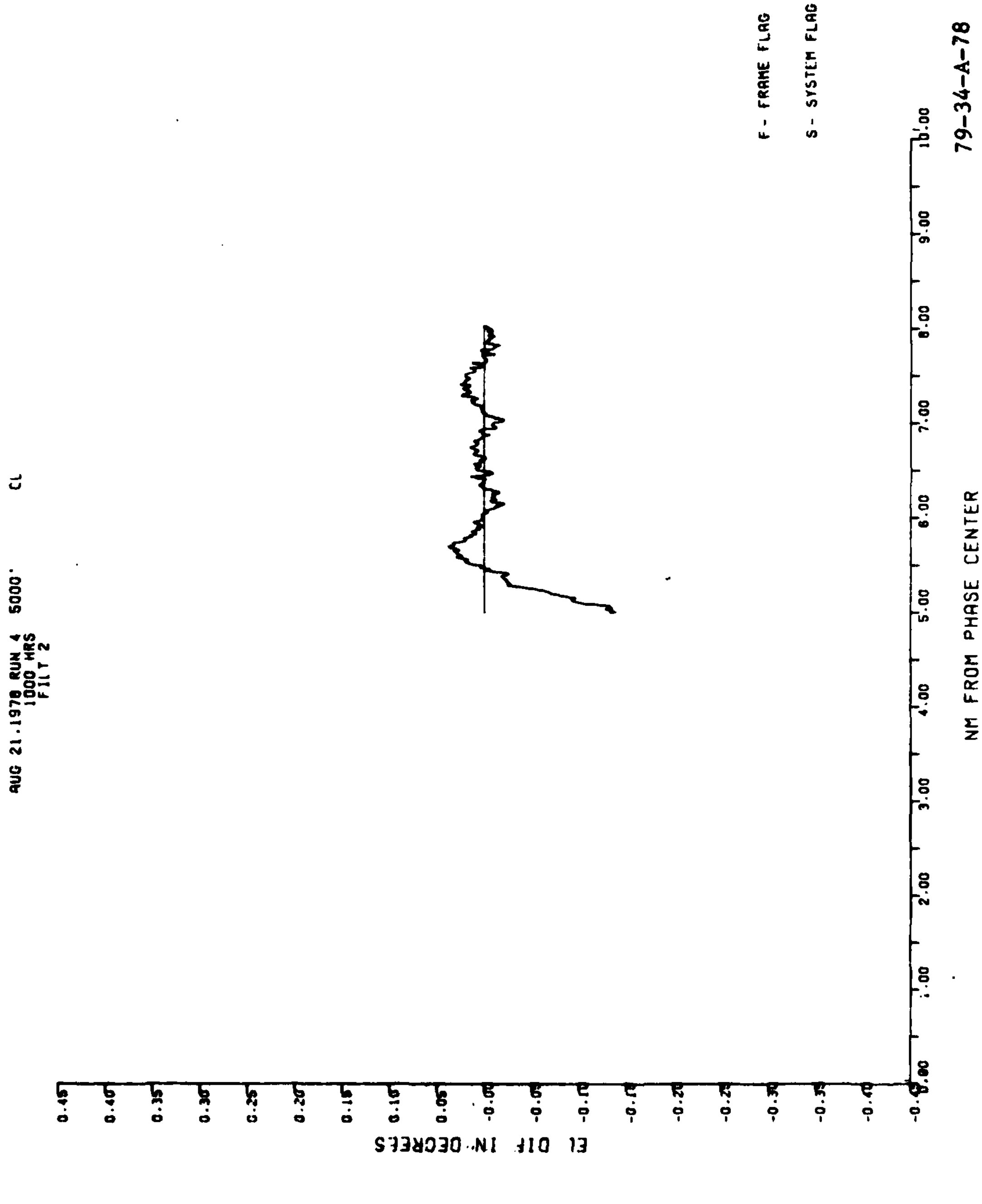
79-34-A-75

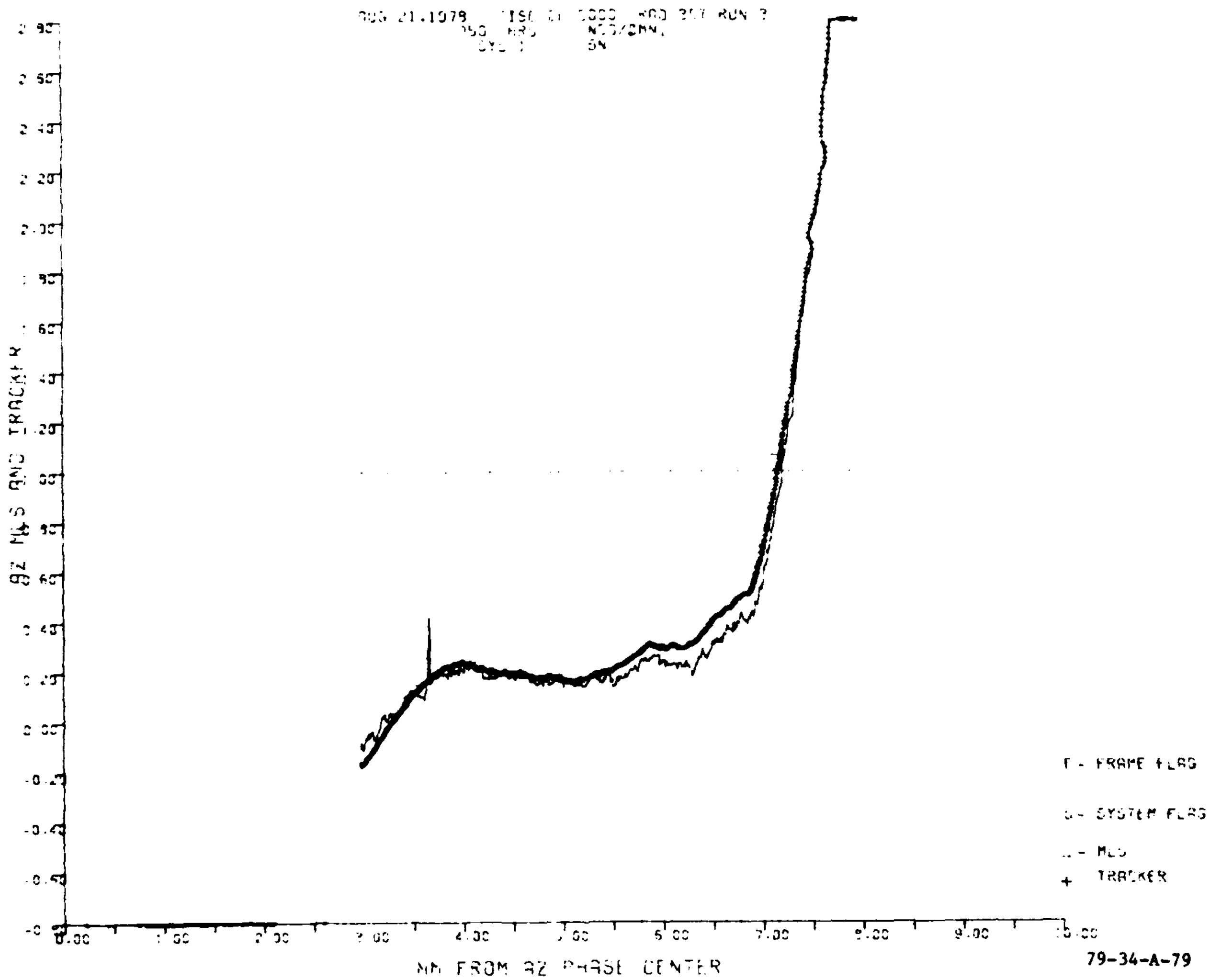

AUG 21.1978 TISC 5000' LEV CL 3ST RUN 4
1000 HRS N50/OMNI
SYS 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
- - MLS
+ - TRACKER
EL MLS AND TRACKER
NM FROM PHASE CENTER
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
-1.00
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
12.00
13.00
14.00
15.00
16.00
17.00
79-34-A-76



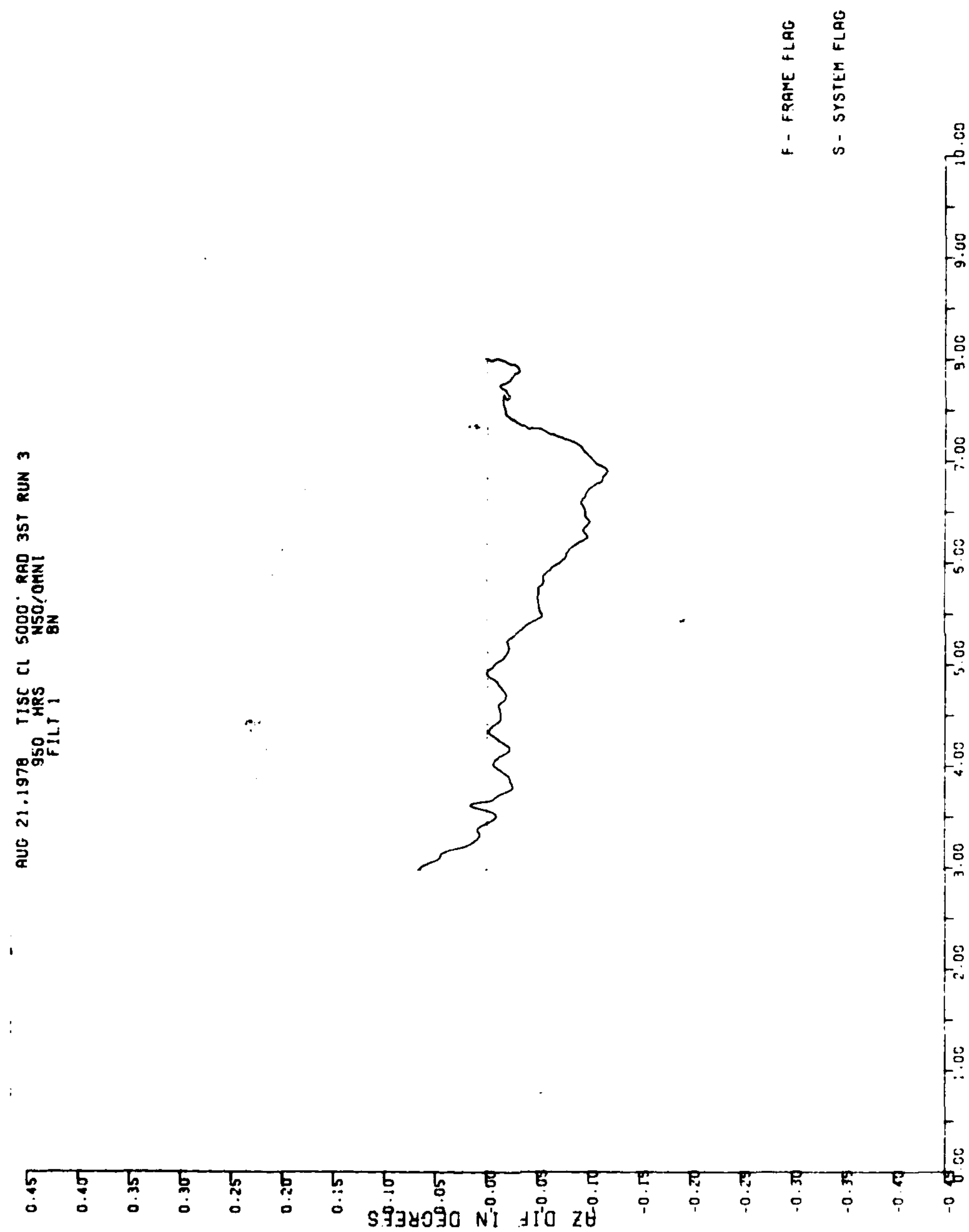
AUG 21.1978 RUN 4 5000' CL
1000 HRS
FILT 1
EL DIF IN DEGREES
NM FROM PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-77

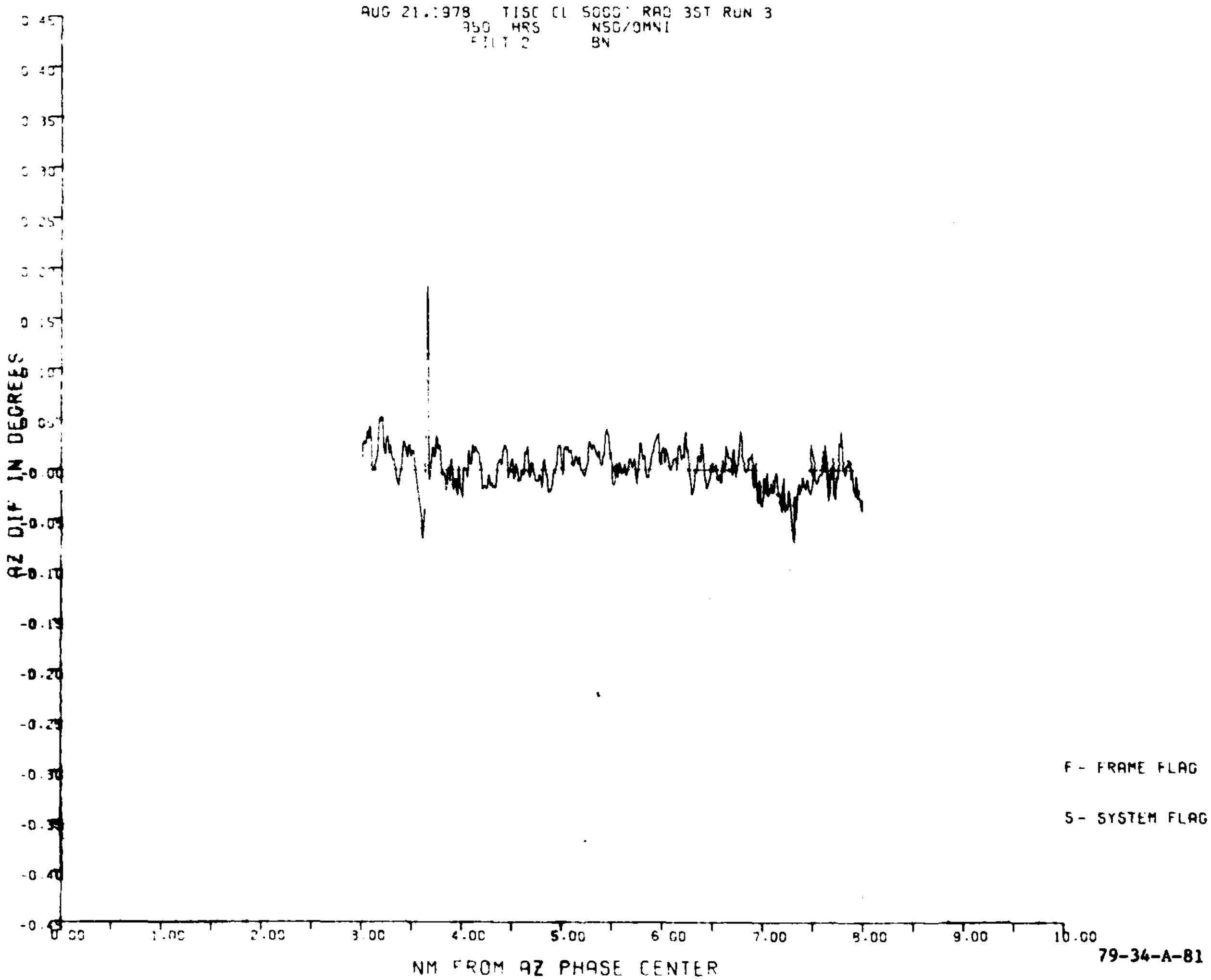

AUG 21.1978 RUN 4 5000' CL
1000 HRS
FILT 2
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-78
NM FROM PHASE CENTER
EL DIF IN DEGREES
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00


AZ MLS AND TRACKER
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
+ TRACKER

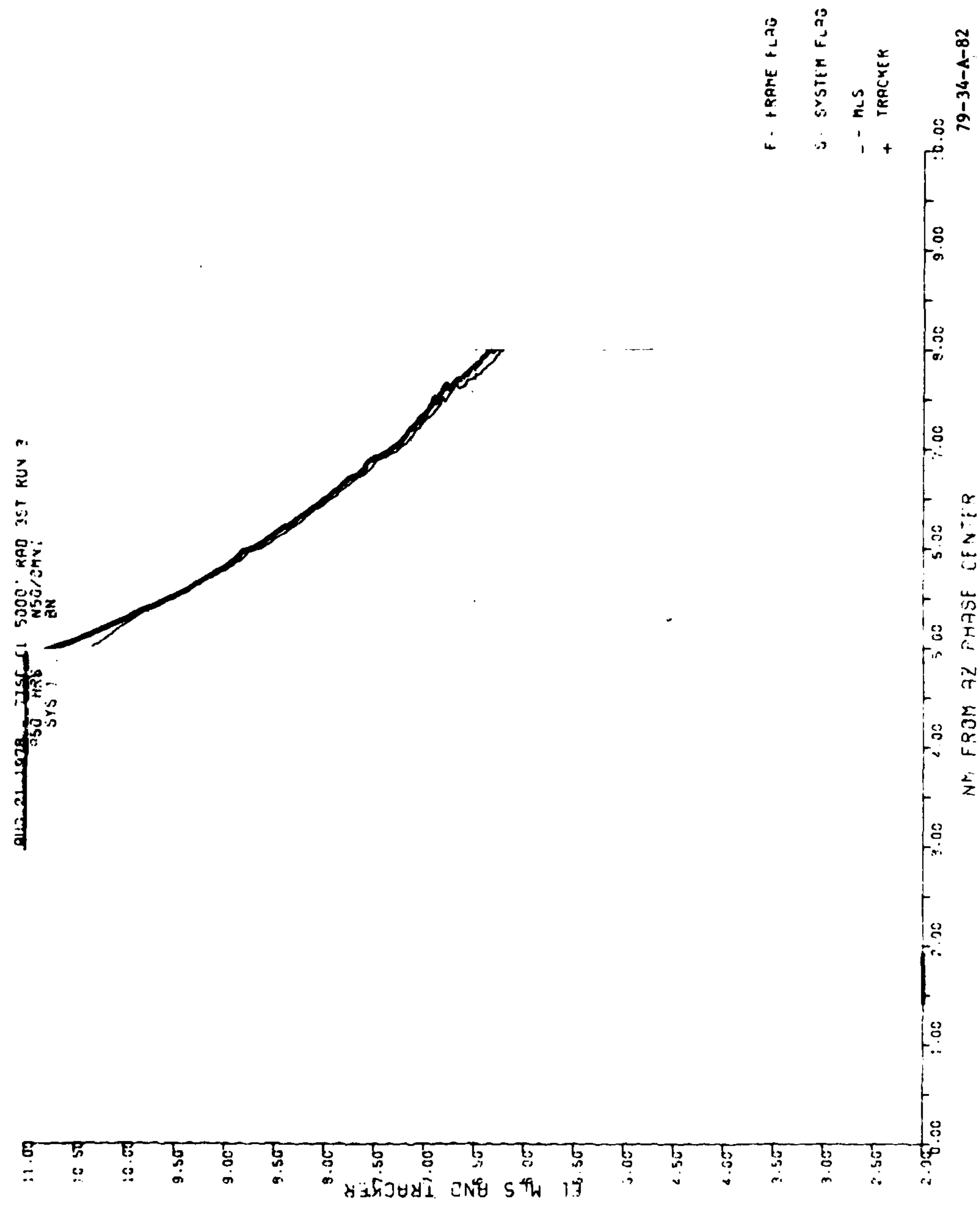
79-34-A-79

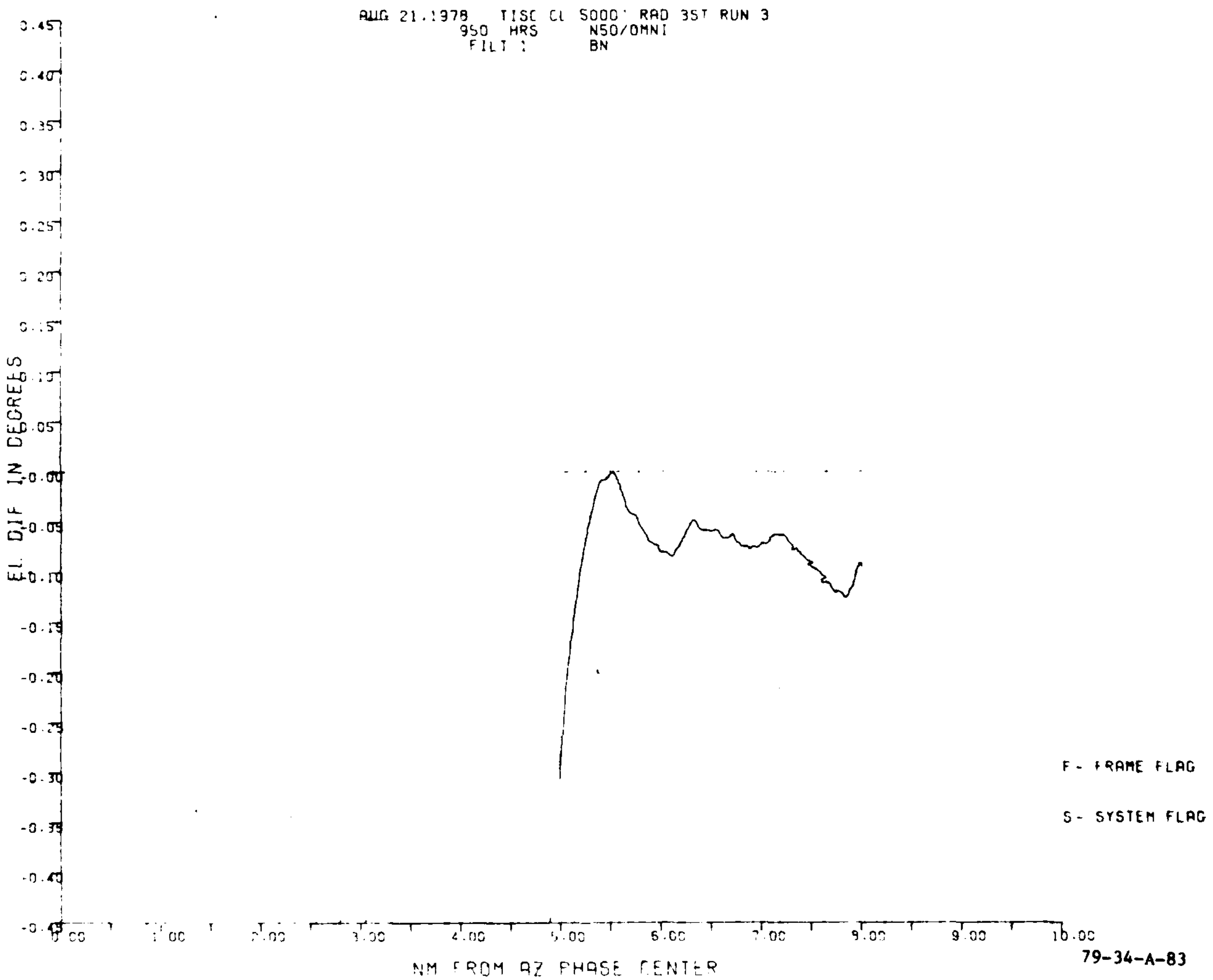

AUG 21,1978 TISC CL 5000' RAD 35T RUN 3
950 HRS N50/OMNI
FILT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
AZ DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
NM FROM AZ PHASE CENTER

79-34-A-80


AUG 21,1978 TISC CL 5000' RAD 3ST RUN 3
950 HRS NSG/OMNI
FILT 2 BN
AZ DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

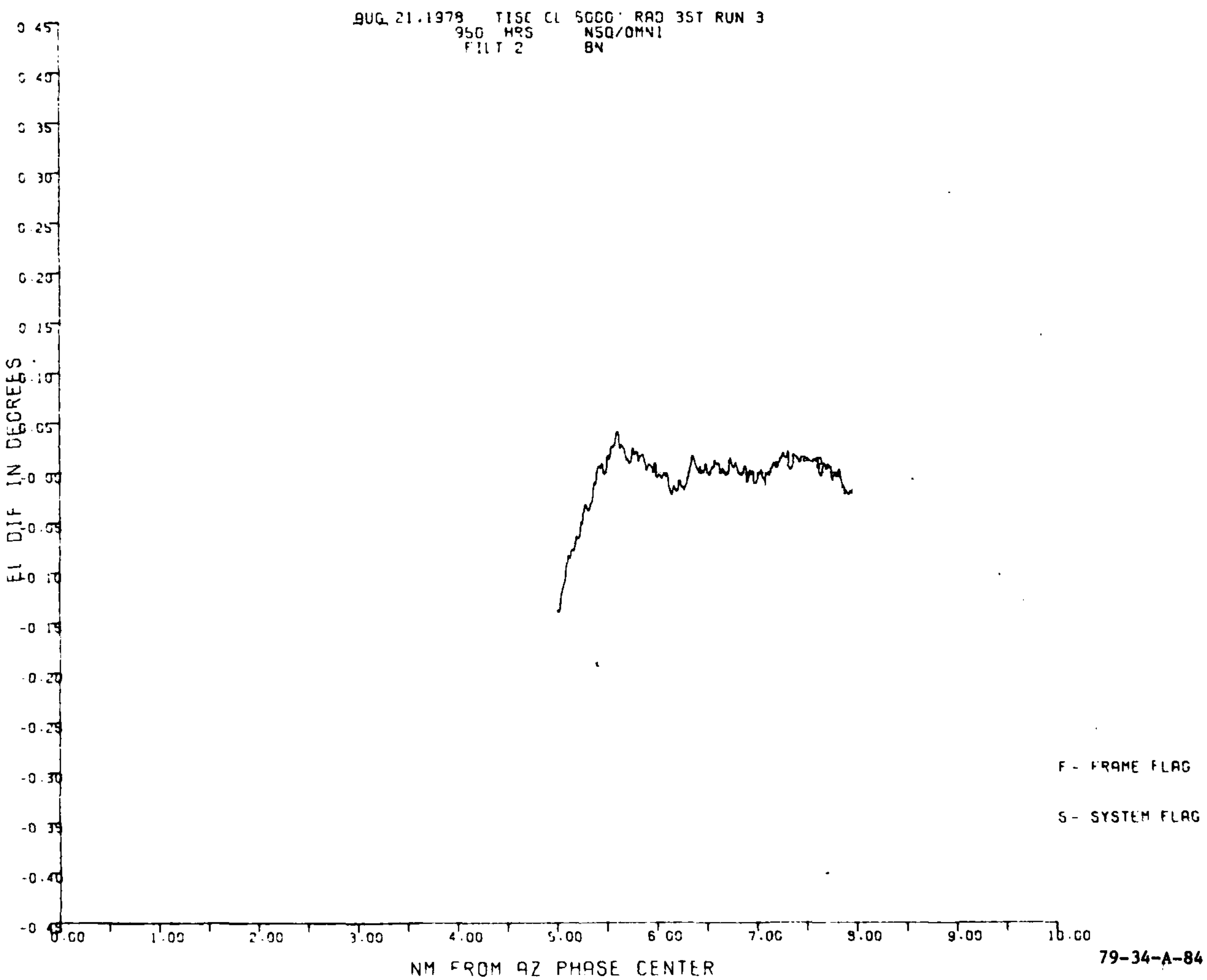
79-34-A-81

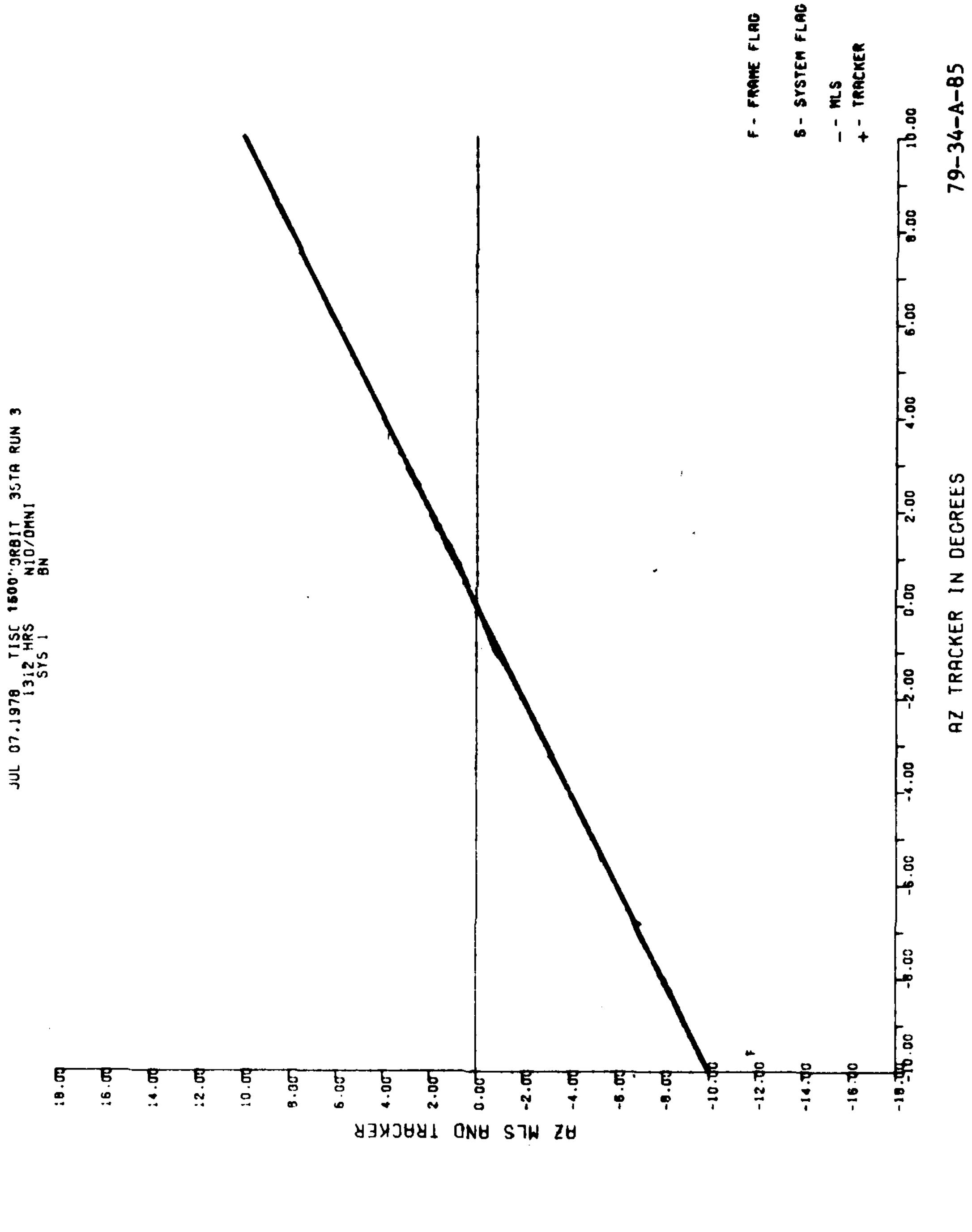

F - FRAME FLAG
S - SYSTEM FLAG
-- MLS
+ TRACKER
NM FROM AZ PHASE CENTER
EL MLS AND TRACKER
79-34-A-82

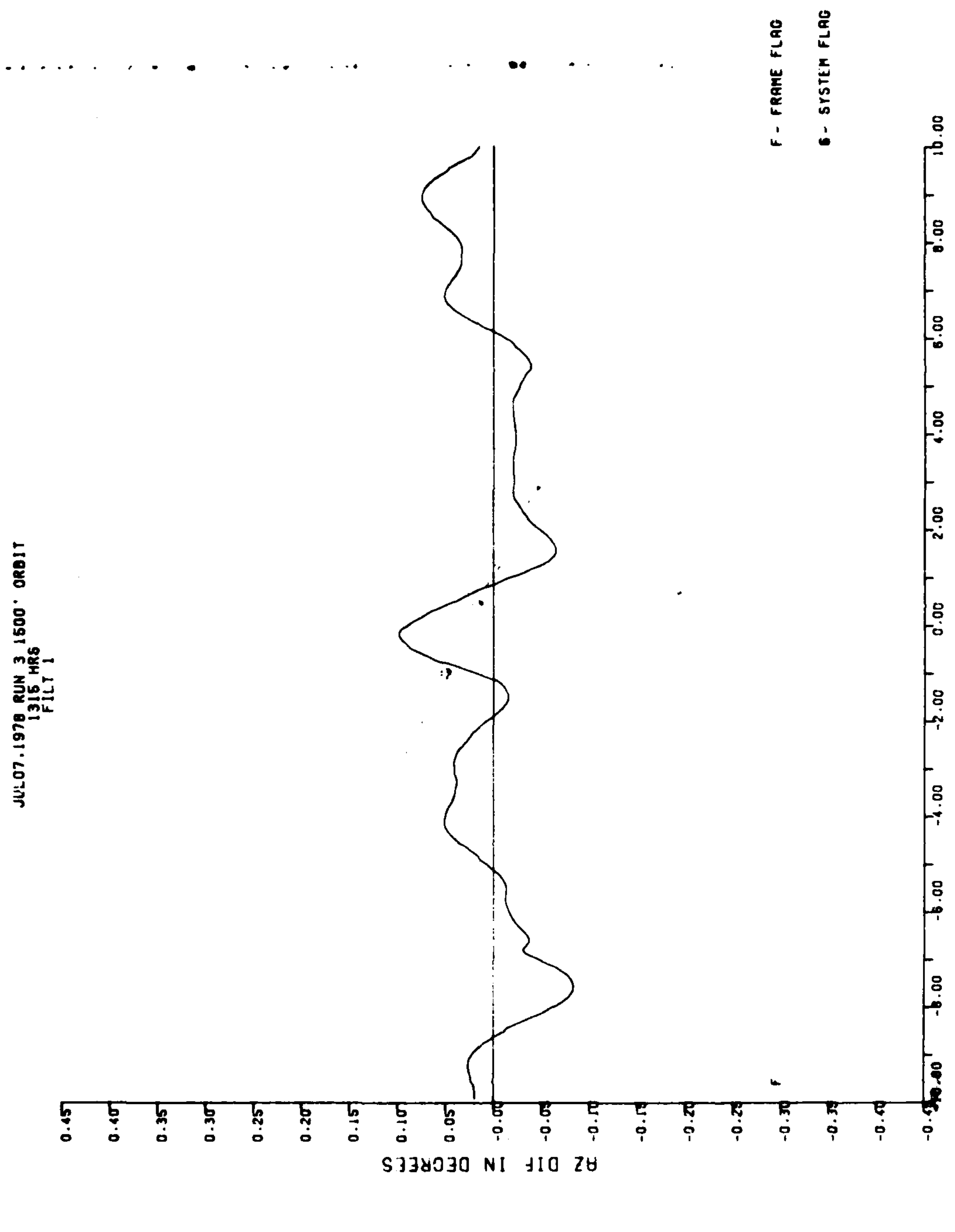


AUG 21.1978 TISC CL 5000' RAD 3ST RUN 3
950 HRS N50/OMNI
FILT 1 BN
EL DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG

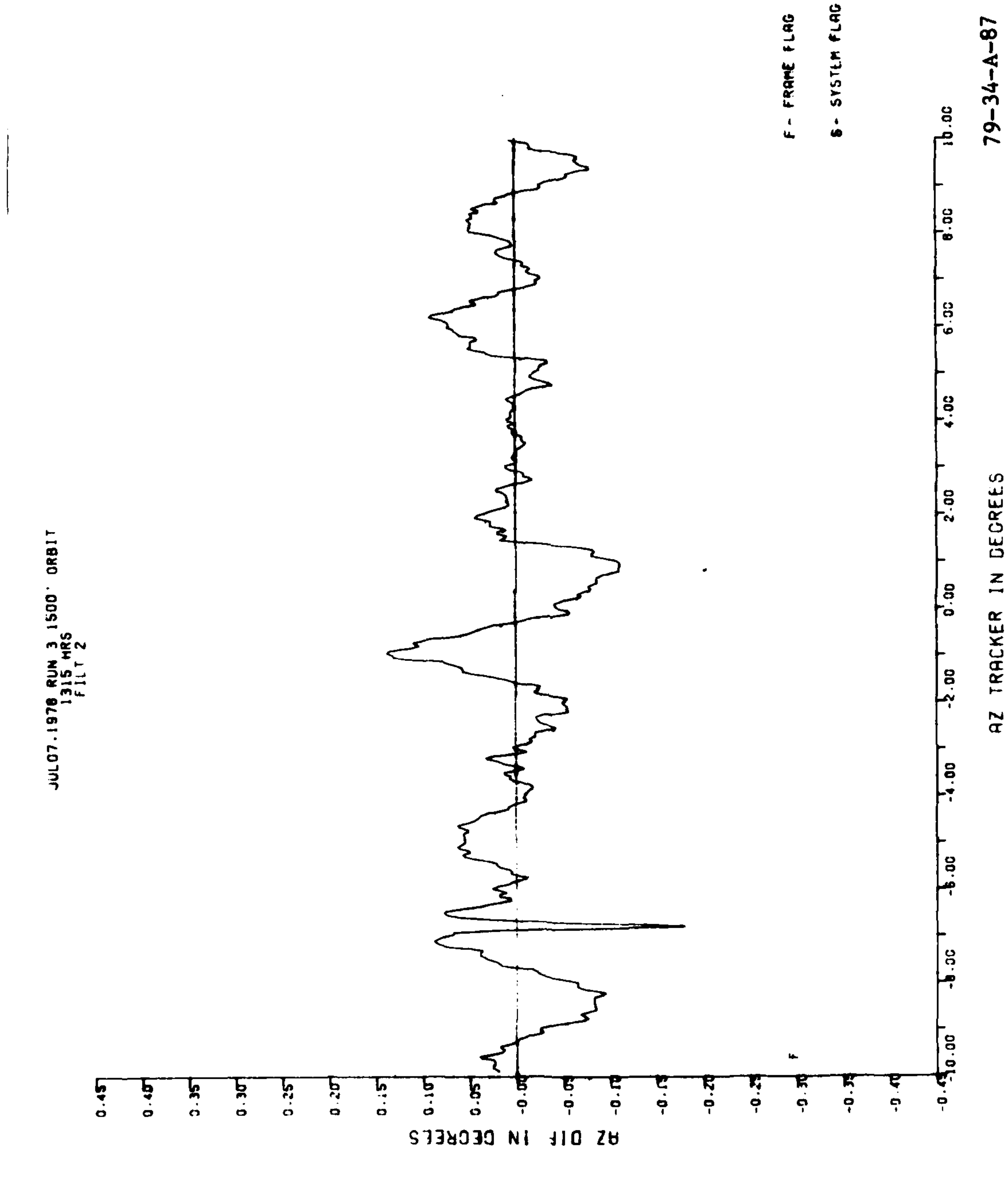
79-34-A-83


AUG 21,1978 TISC CL 5000' RAD 3ST RUN 3
950 HRS NSQ/OMNI
FILT 2 BN
EL DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-84

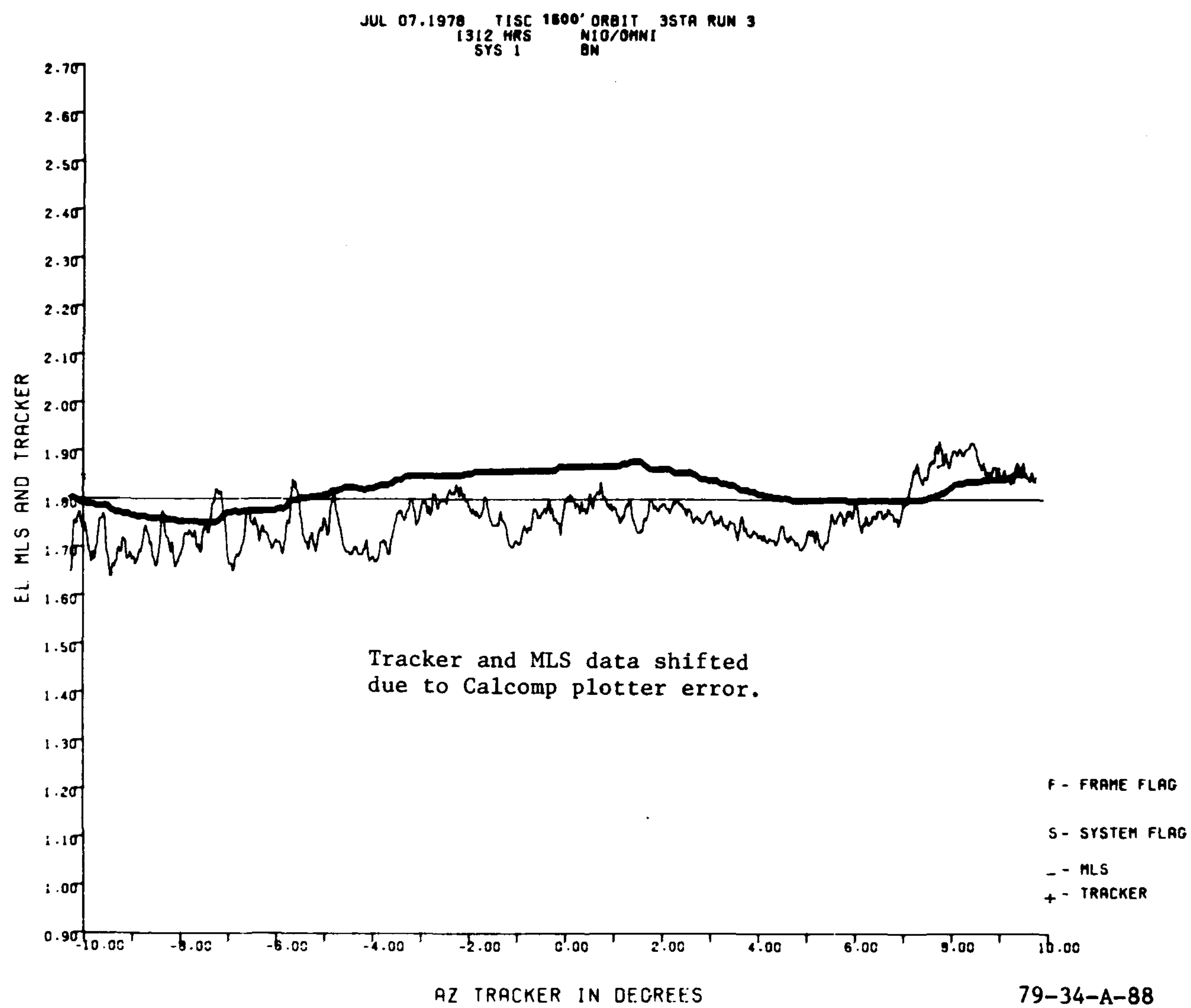

JUL 07,1978 TISC 1600 ORBIT 35TA RUN 3
1312 HRS N10/OMNI
SYS 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
- - MLS
+ - TRACKER
AZ MLS AND TRACKER
AZ TRACKER IN DEGREES
79-34-A-85


JUL07.1978 RUN 3 1500' ORBIT
1315 HRS
FILT 1
AZ DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-0.00
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00

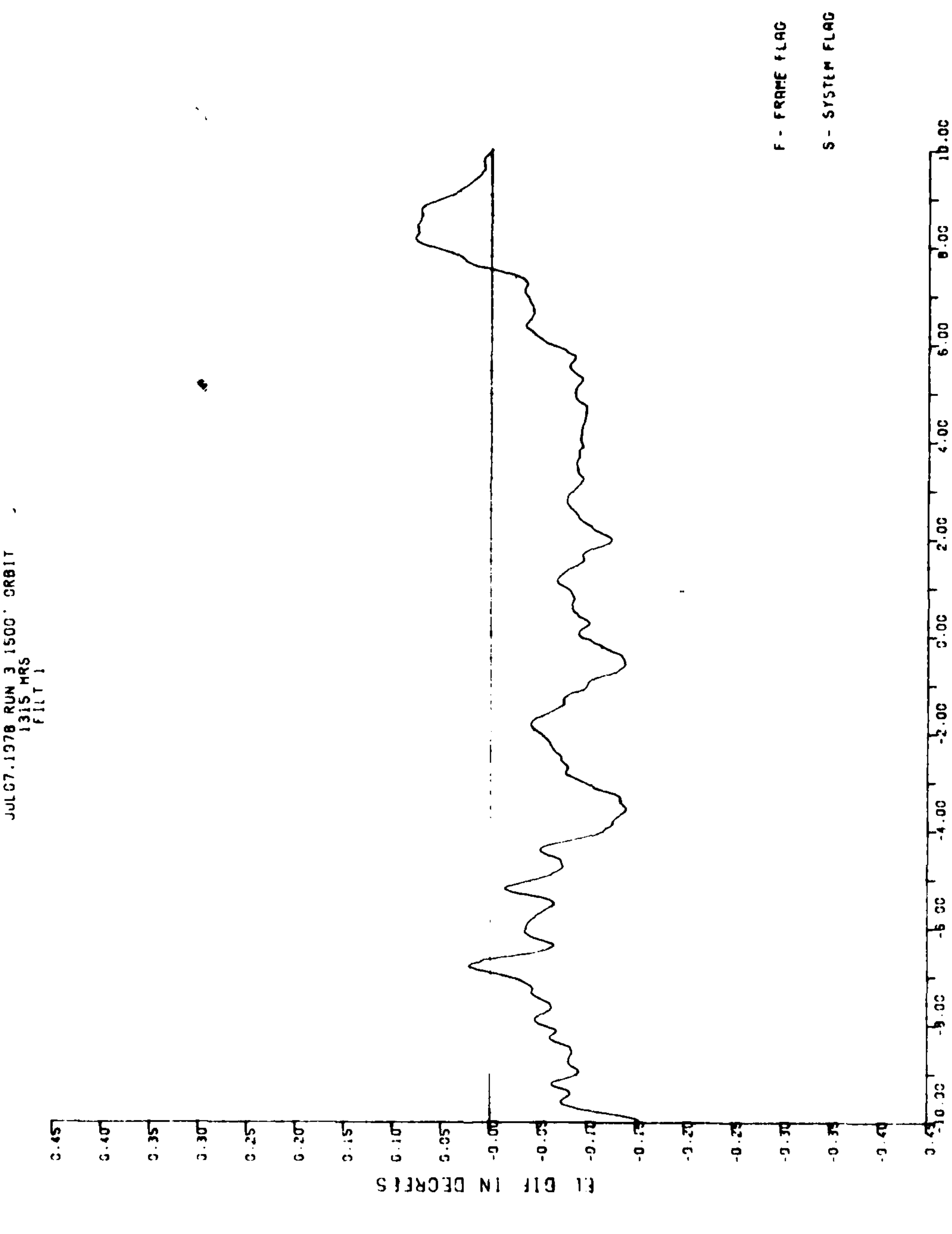
79-34-A-86


JUL07.1978 RUN 3 1500' ORBIT
1315 HRS
FILT 2
F - FRAME FLAG
S - SYSTEM FLAG
AZ TRACKER IN DEGREES
AZ DIF IN DEGREES
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
F

79-34-A-87


JUL 07.1978 TISC 1800' ORBIT 3STA RUN 3
1312 HRS NIO/OMNI
SYS 1 BN
EL MLS AND TRACKER
2.70
2.60
2.50
2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
Tracker and MLS data shifted
due to Calcomp plotter error.
F - FRAME FLAG
S - SYSTEM FLAG
_ - MLS
+ - TRACKER
AZ TRACKER IN DEGREES

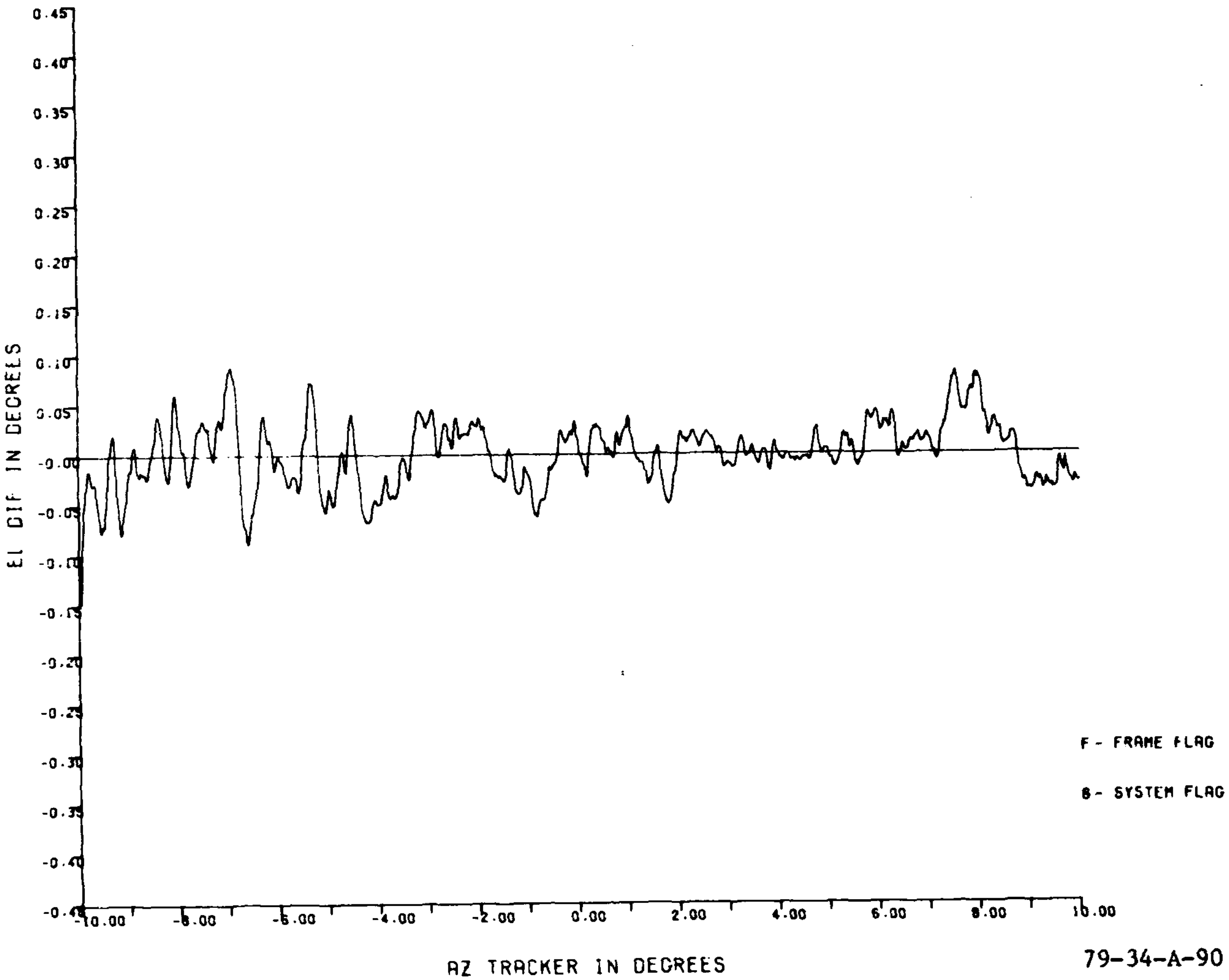
79-34-A-88



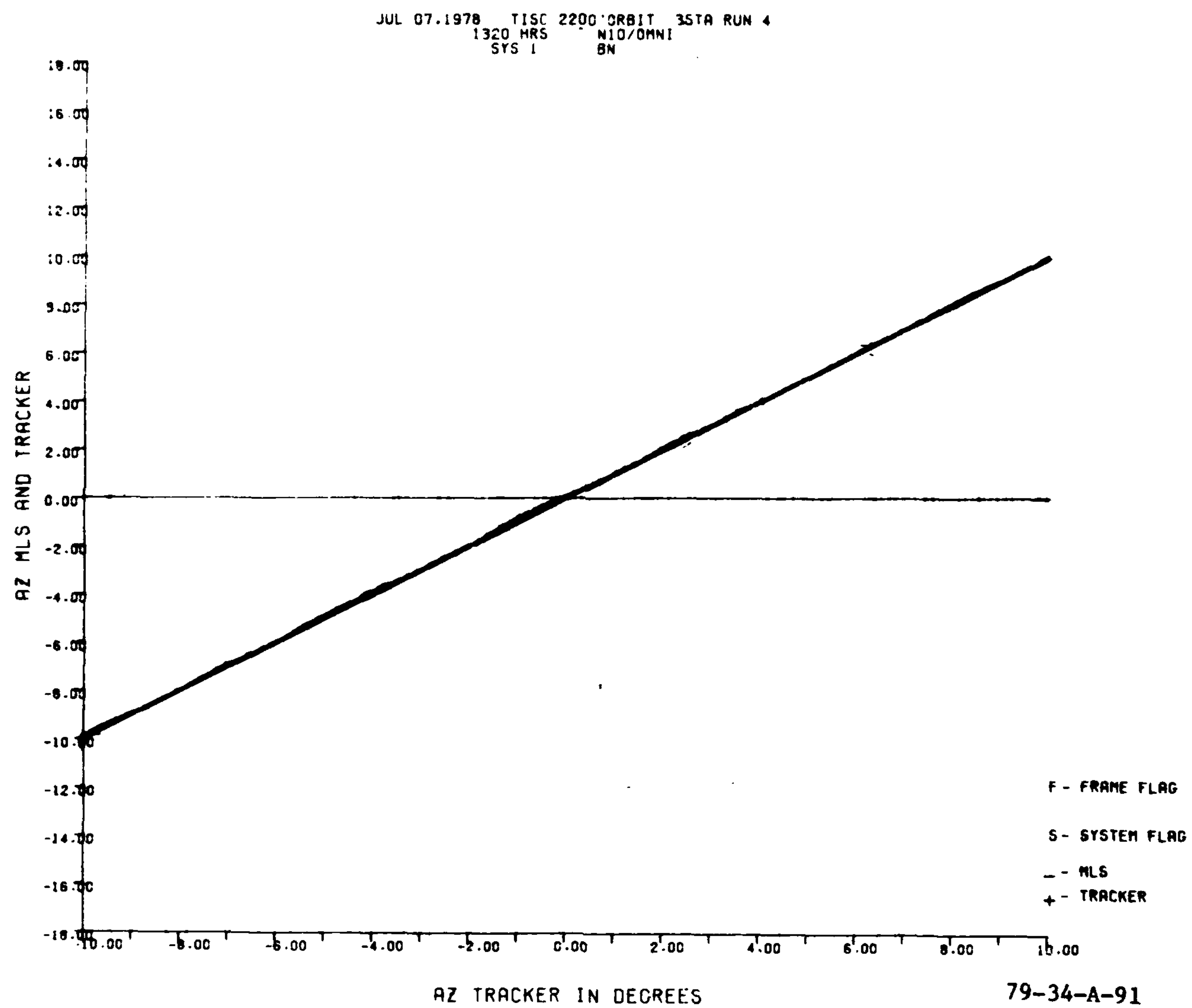
JULY7.1978 RUN 3 1500' ORBIT
1315 HRS
FILT 1
F - FRAME FLAG
S - SYSTEM FLAG
AZ TRACKER IN DEGREES
EL DIF IN DEGREES

79-34-A-89

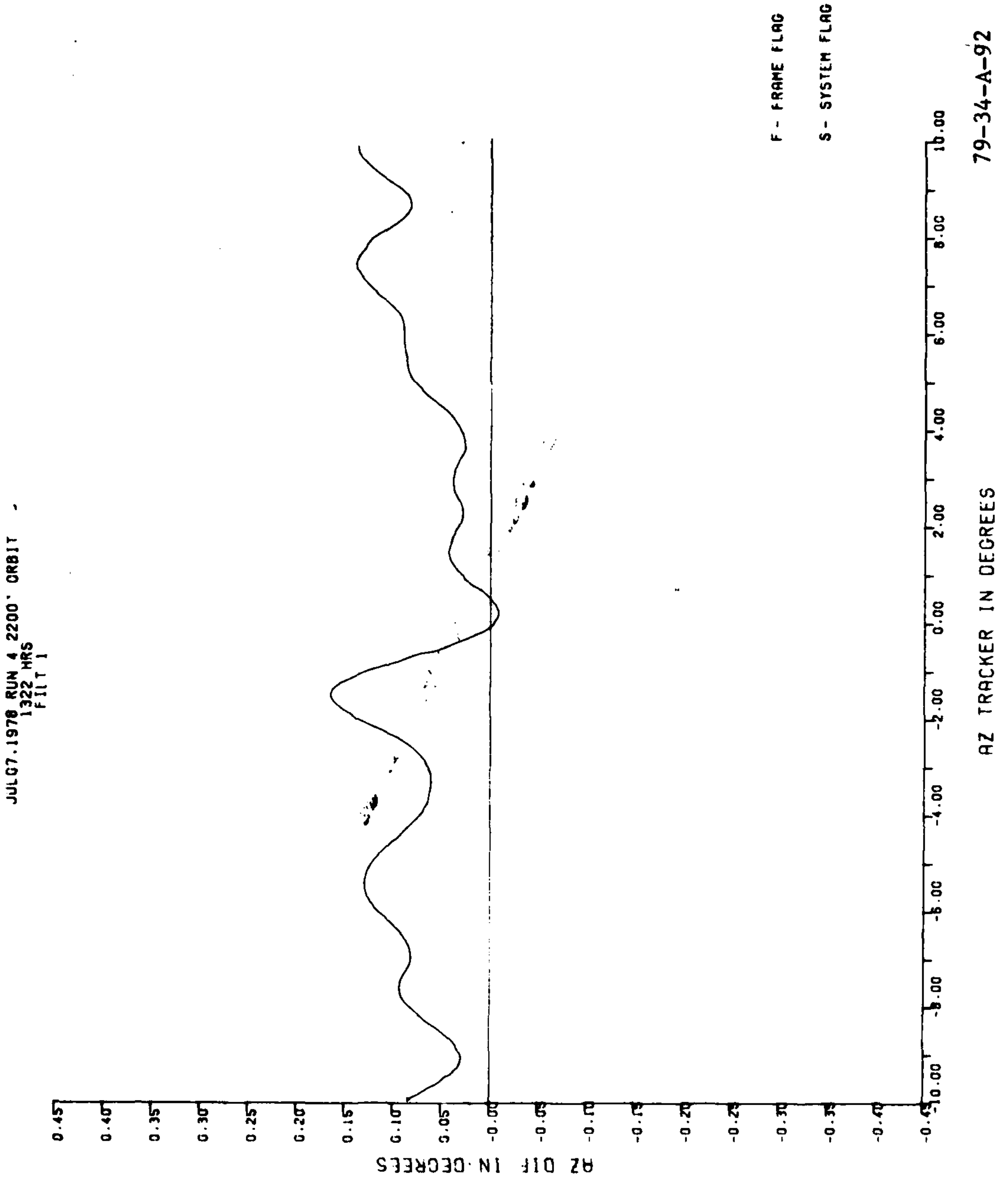
JUL07.1978 RUN 3 1500' ORBIT
1315 HRS
FILT 2

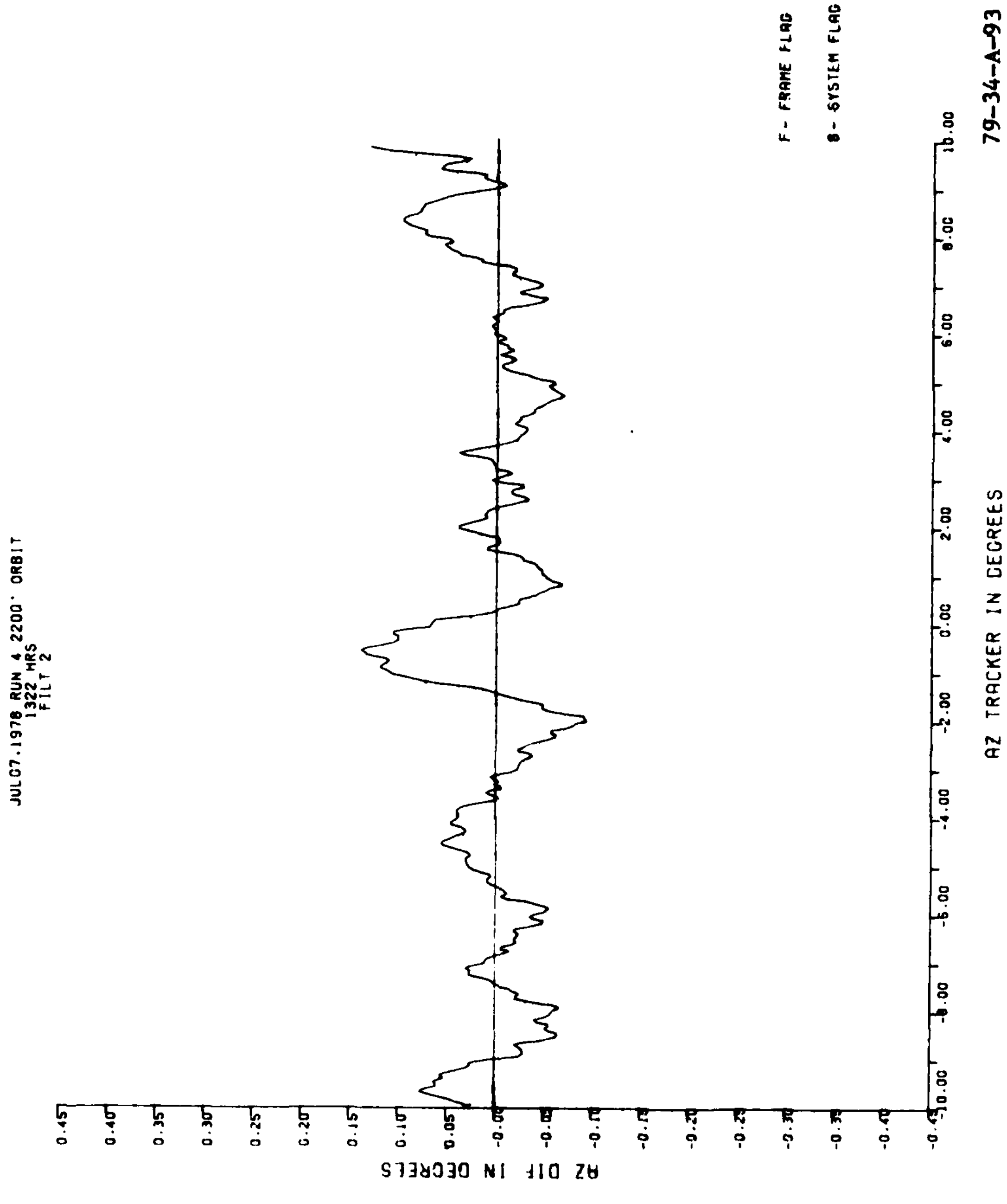


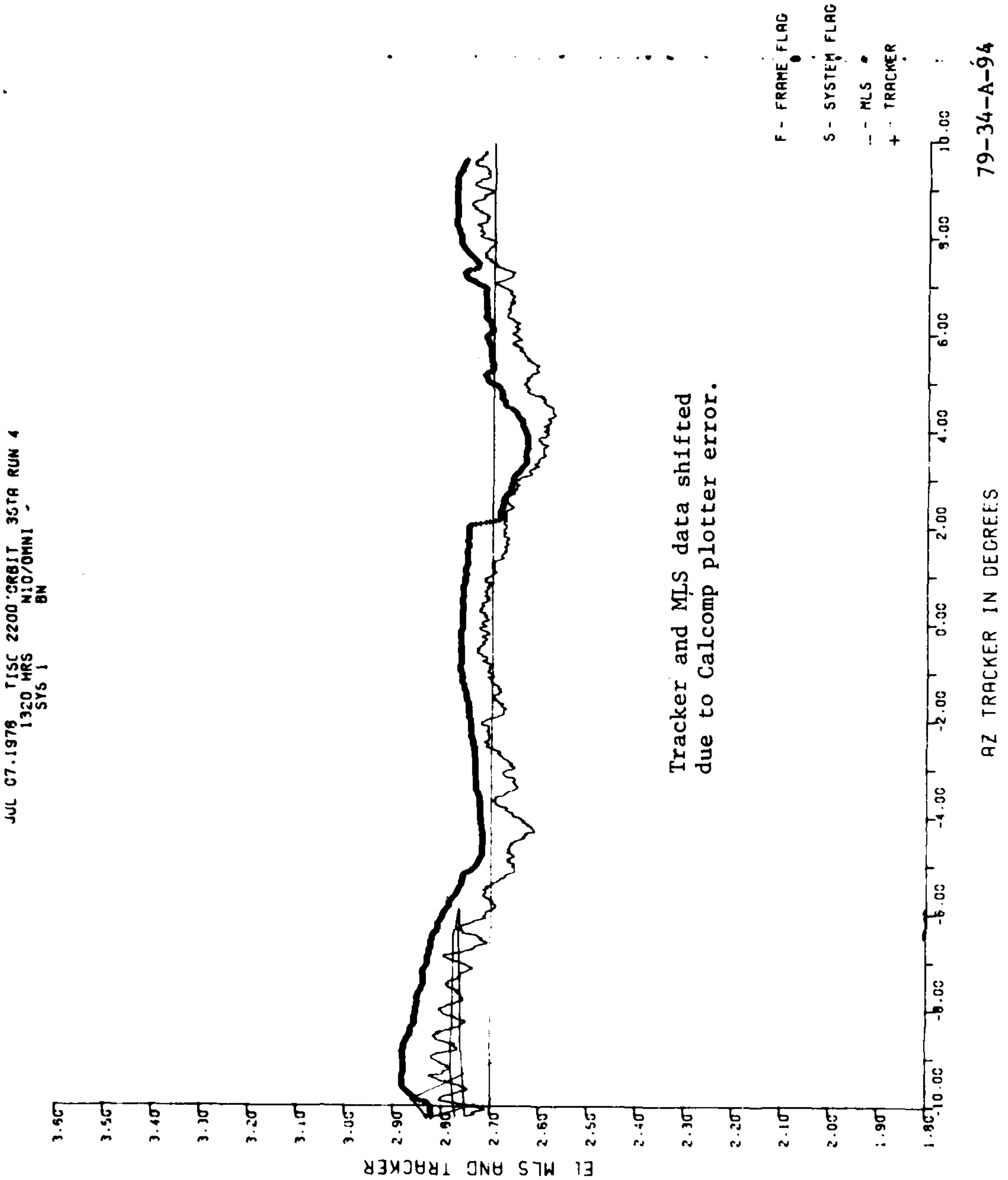
79-34-A-90

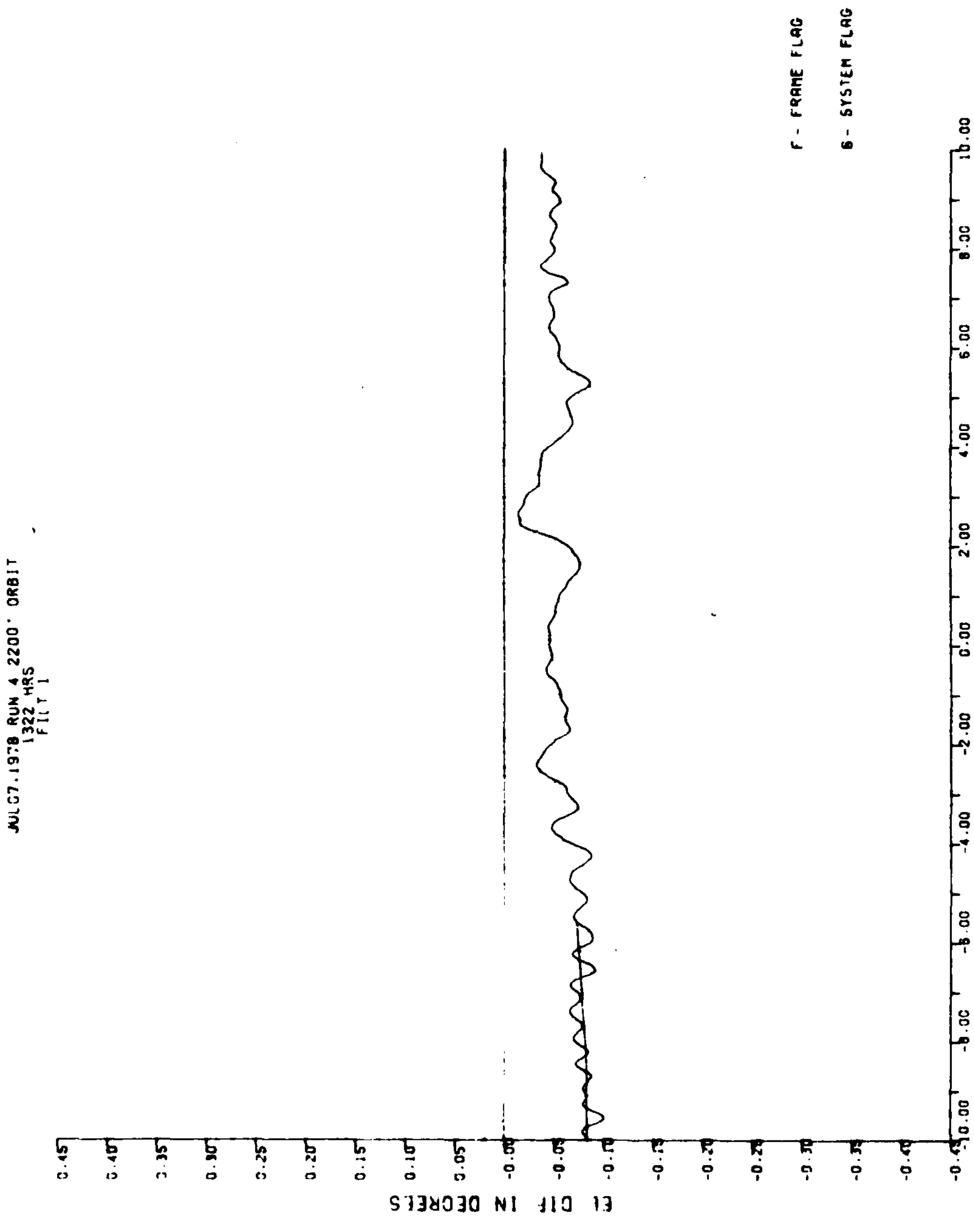

JUL 07.1978 TISC 2200 ORBIT 3STA RUN 4
1320 HRS N10/OMNI
SYS 1 BN
AZ MLS AND TRACKER
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
-18.00
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
_ - MLS
+ - TRACKER

79-34-A-91

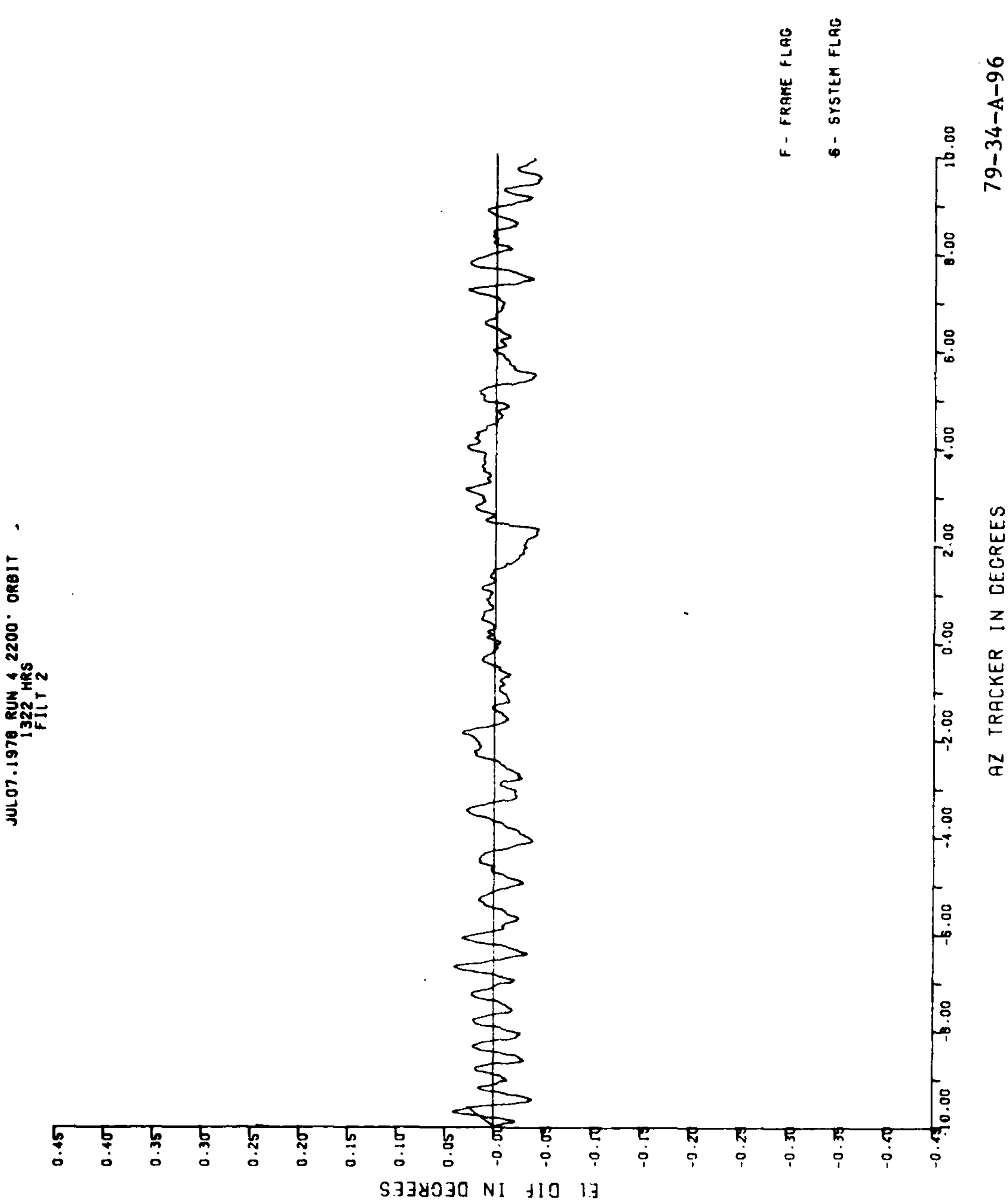

JULG7.1978 RUN 4 2200' ORBIT
1322 HRS
FILT 1
AZ DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-92

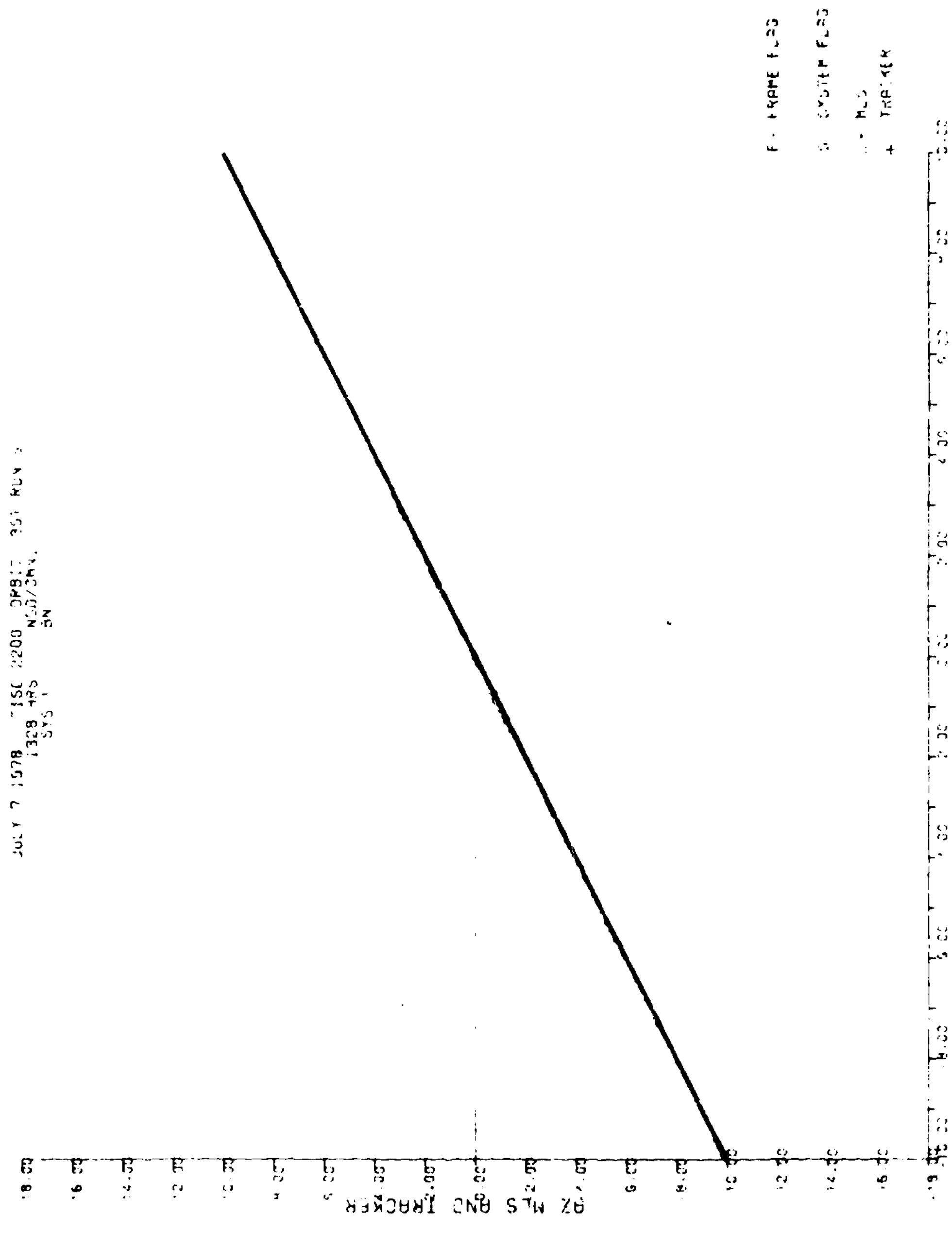

JUL07.1978 RUN 4 2200' ORBIT
1322 HRS
FILT 2
F - FRAME FLAG
S - SYSTEM FLAG
AZ TRACKER IN DEGREES
AZ DIF IN DEGREES
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
79-34-A-93


JUL 07.1978 TISC 2200 ORBIT 3STA RUN 4
1320 HRS N10/OMNI
SYS 1 BN
Tracker and MLS data shifted
due to Calcomp plotter error.
F - FRAME FLAG
S - SYSTEM FLAG
- MLS
+ TRACKER
EL MLS AND TRACKER
3.60
3.50
3.40
3.30
3.20
3.10
3.00
2.90
2.80
2.70
2.60
2.50
2.40
2.30
2.20
2.10
2.00
1.90
1.80
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
AZ TRACKER IN DEGREES
79-34-A-94


JUL07.1978 RUN 4 2200' ORBIT
1322 HRS
FILT 1
F - FRAME FLAG
S - SYSTEM FLAG
AZ TRACKER IN DEGREES
EL DIF IN DEGREES
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45

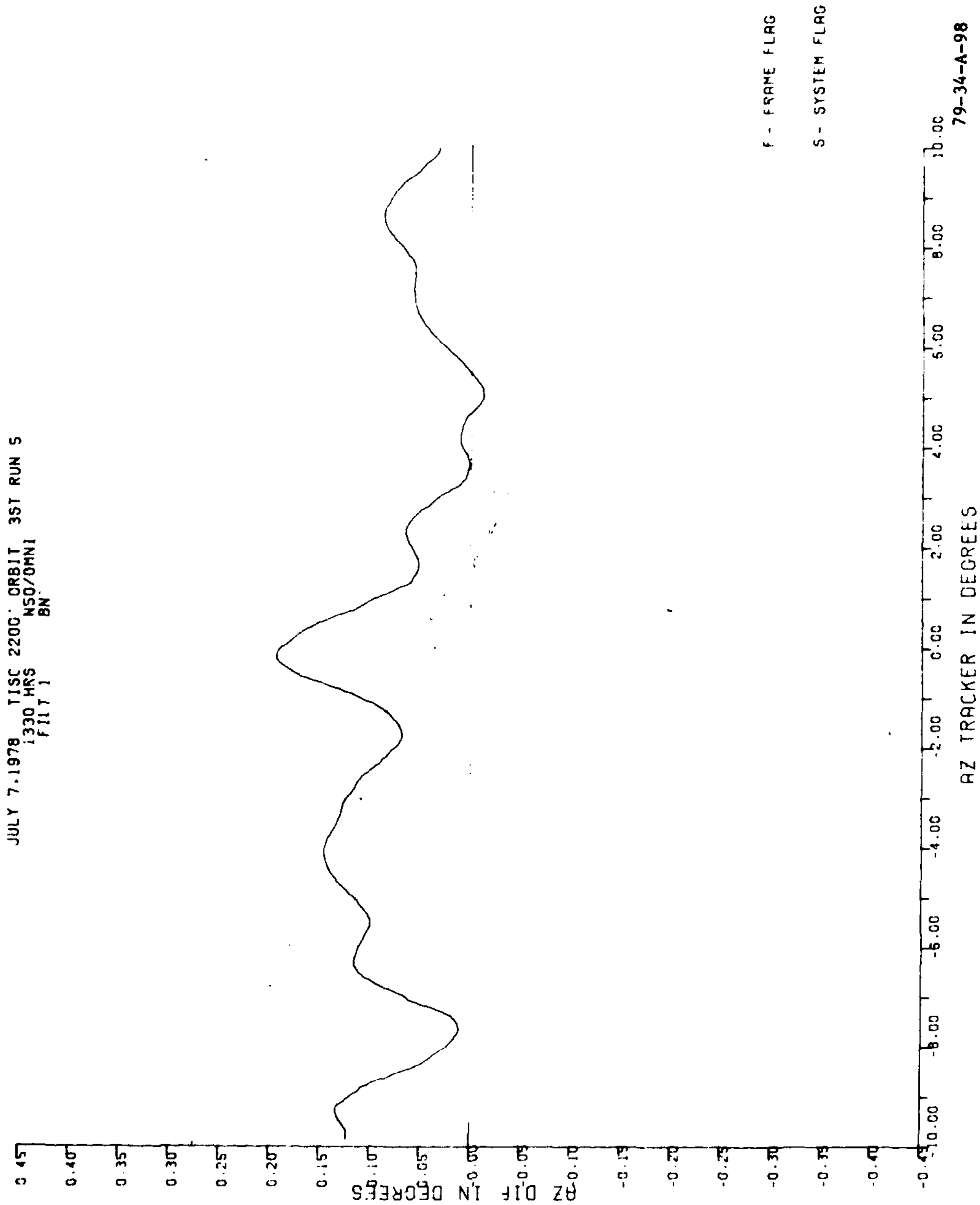
79-34-A-95


JUL07.1978 RUN 4 2200' ORBIT
1322 HRS
FILT 2
F - FRAME FLAG
$ - SYSTEM FLAG
AZ TRACKER IN DEGREES
EL DIF IN DEGREES
79-34-A-96

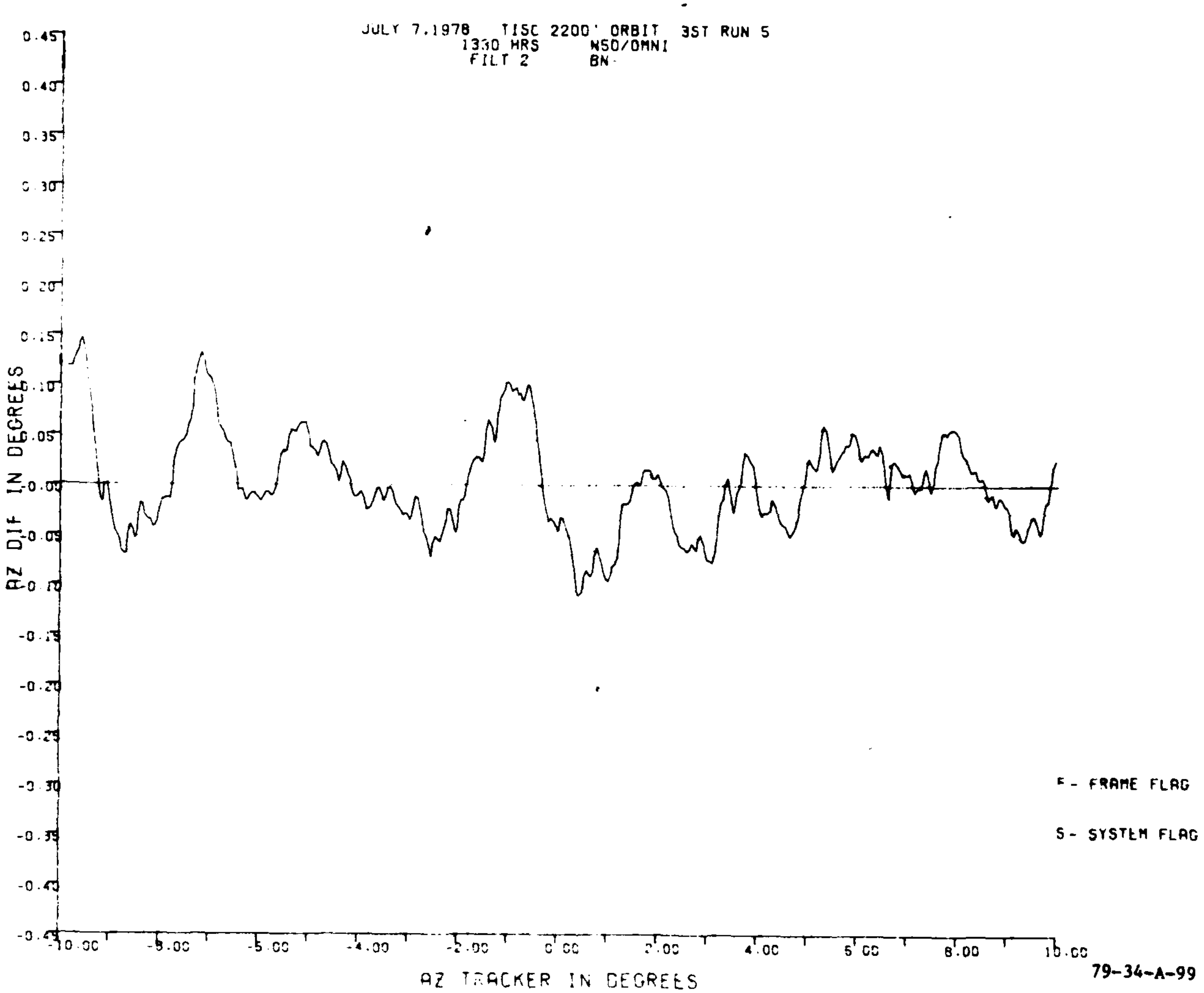


JULY 7 1978 TISC 2200 ORBIT 357 RUN 3
AZ MLS AND TRACKER
AZ TRACKER IN DEGREES
FRAME FLAG
SYSTEM FLAG
MLS
+ TRACKER

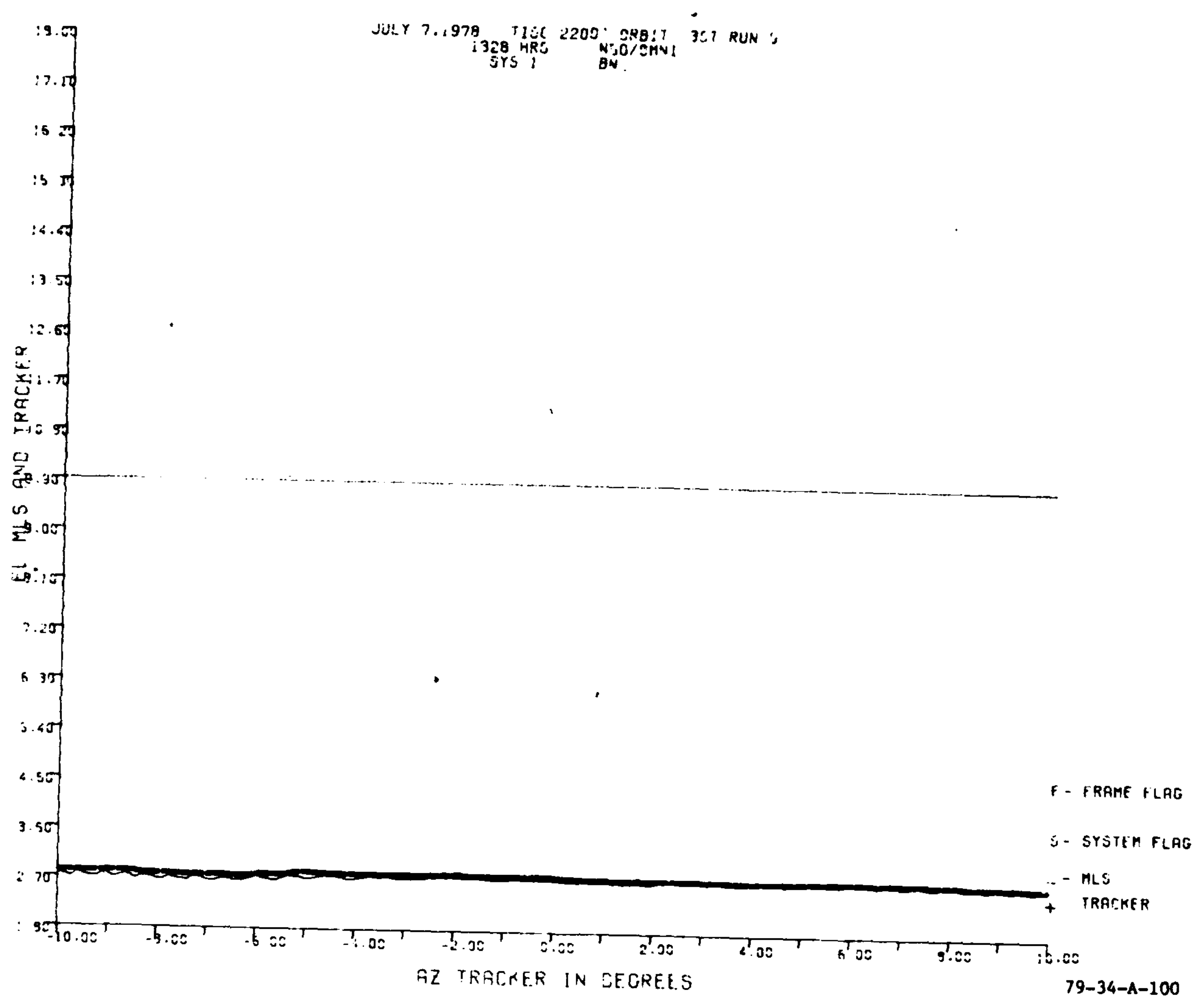
79-36-A-97


JULY 7.1978 TISC 2200' ORBIT 3ST RUN 5
1330 HRS NSO/OMNI
FIIT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
AZ TRACKER IN DEGREES
AZ DIF IN DEGREES
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45

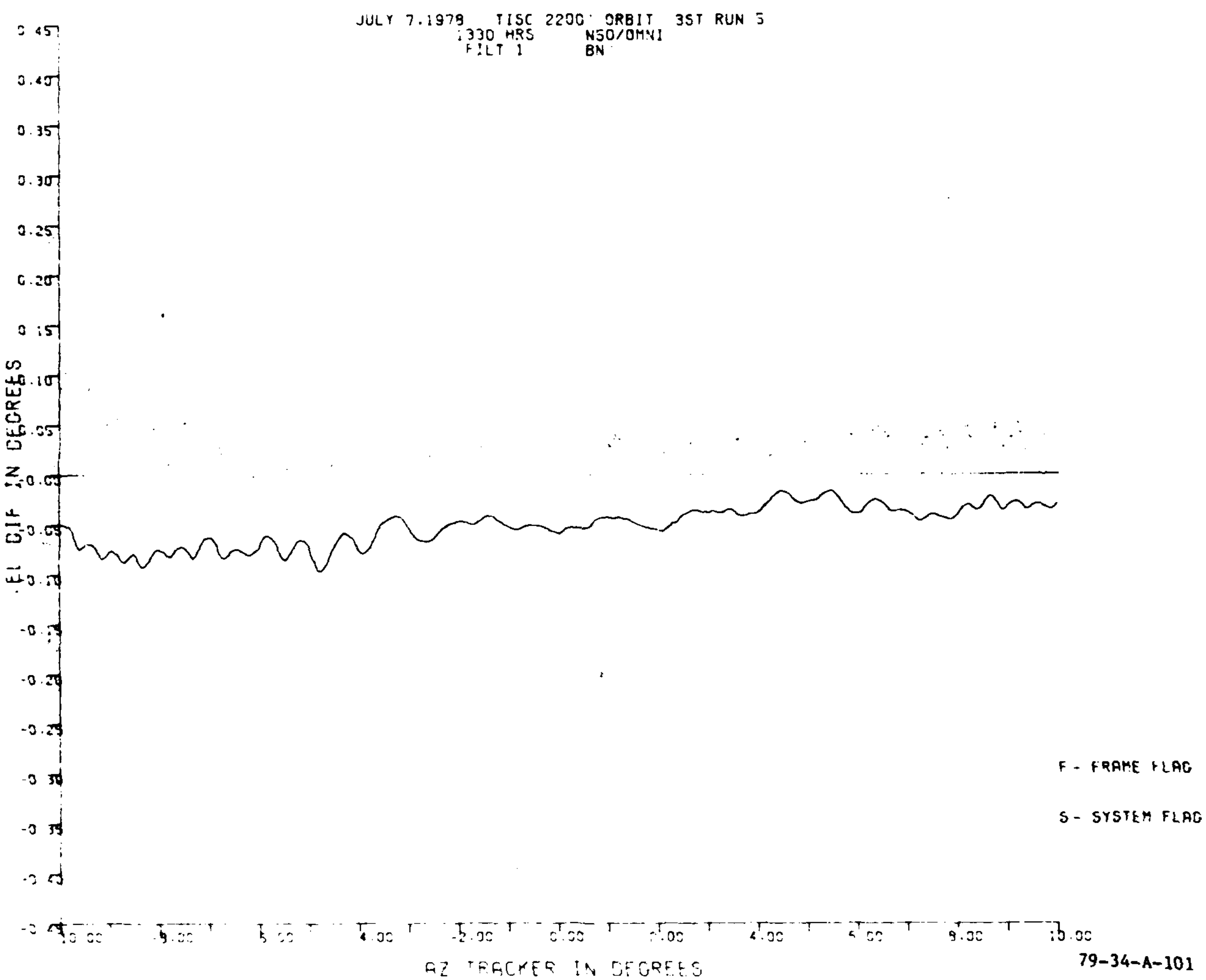
79-34-A-98

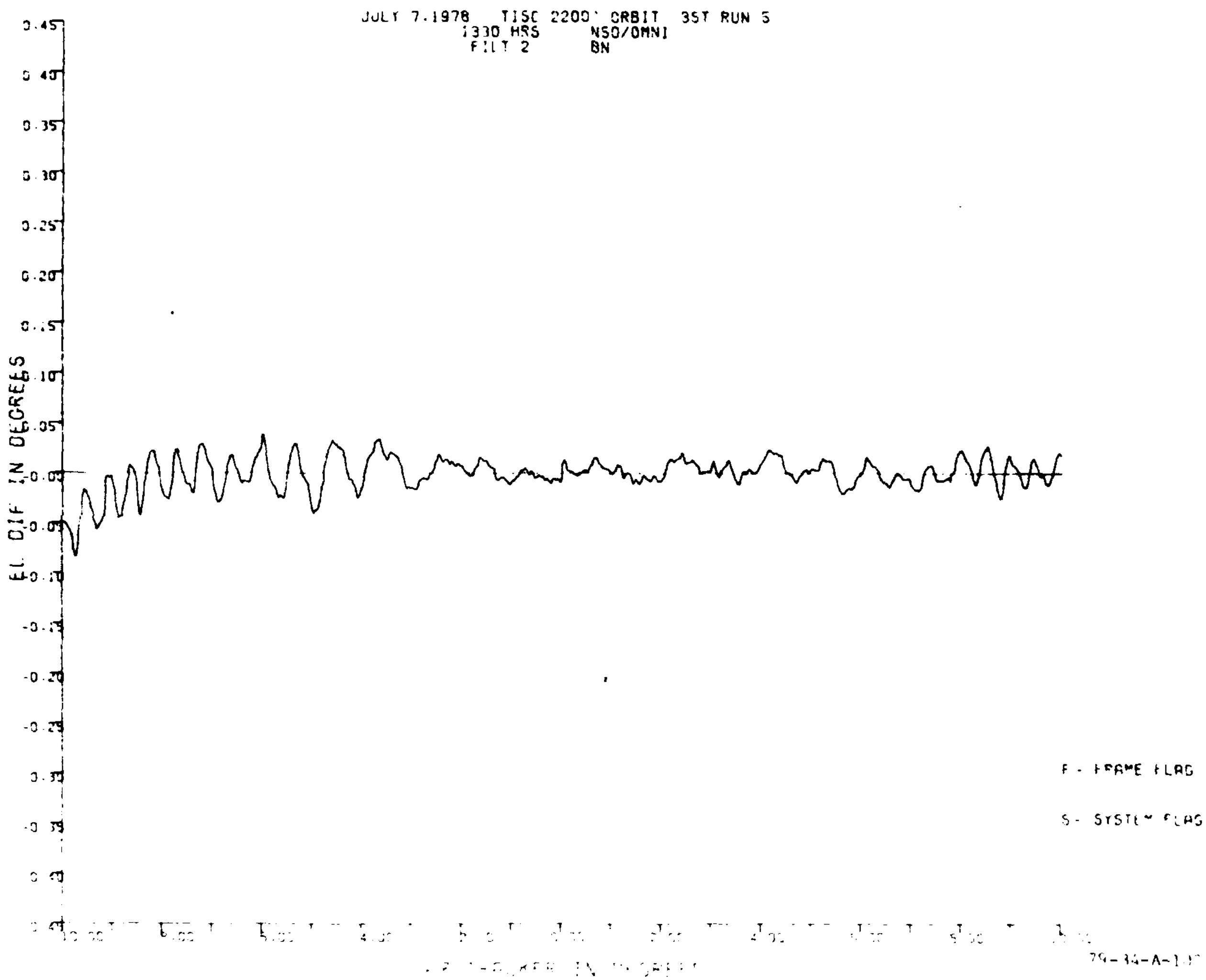

JULY 7,1978 TISC 2200' ORBIT 3ST RUN 5
1330 HRS NSO/OMNI
FILT 2 BN
AZ DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG

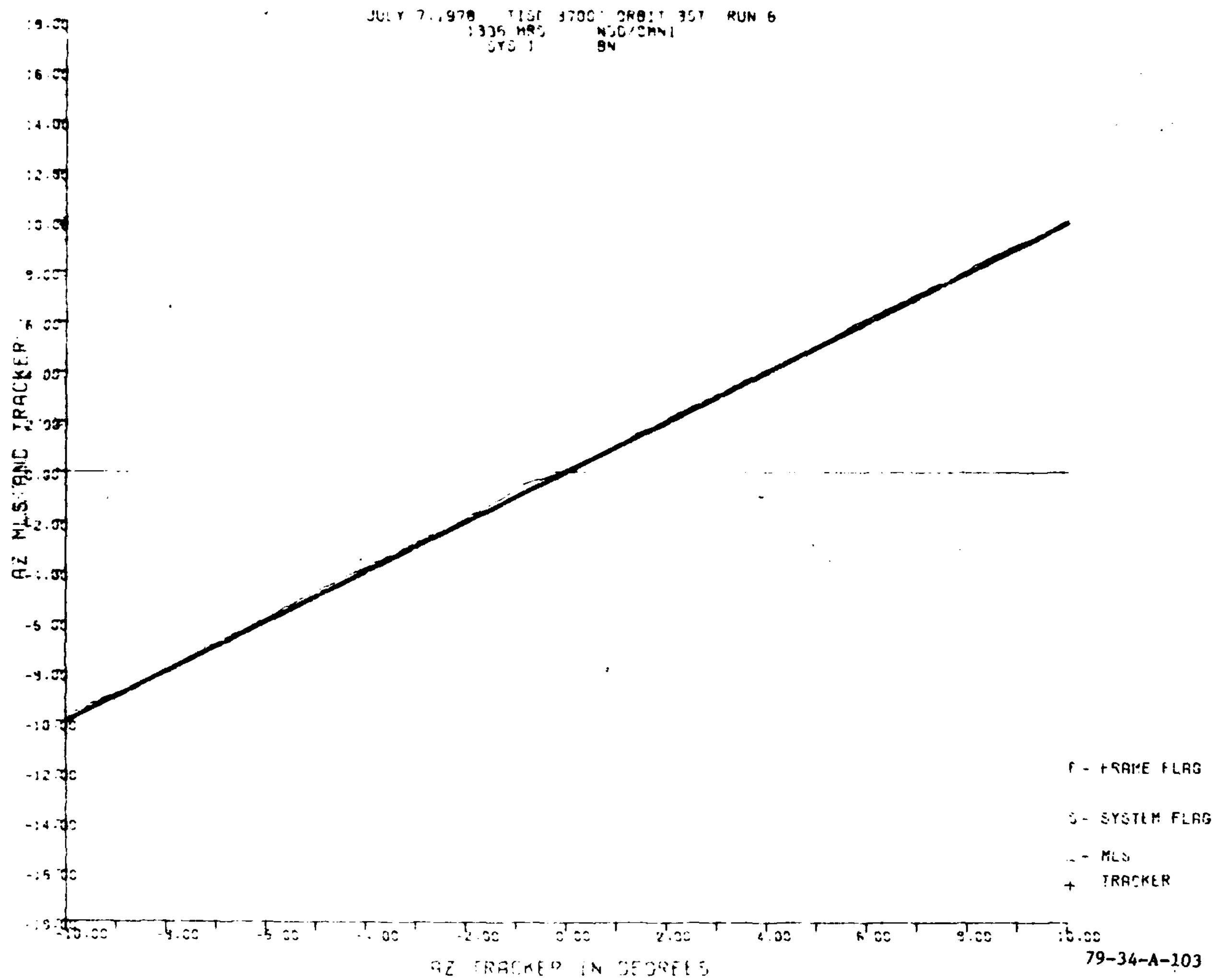
79-34-A-99


JULY 7,1978
1328 HRS
SYS 1
BN
EL MLS AND TRACKER
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
- MLS
+ TRACKER

79-34-A-100

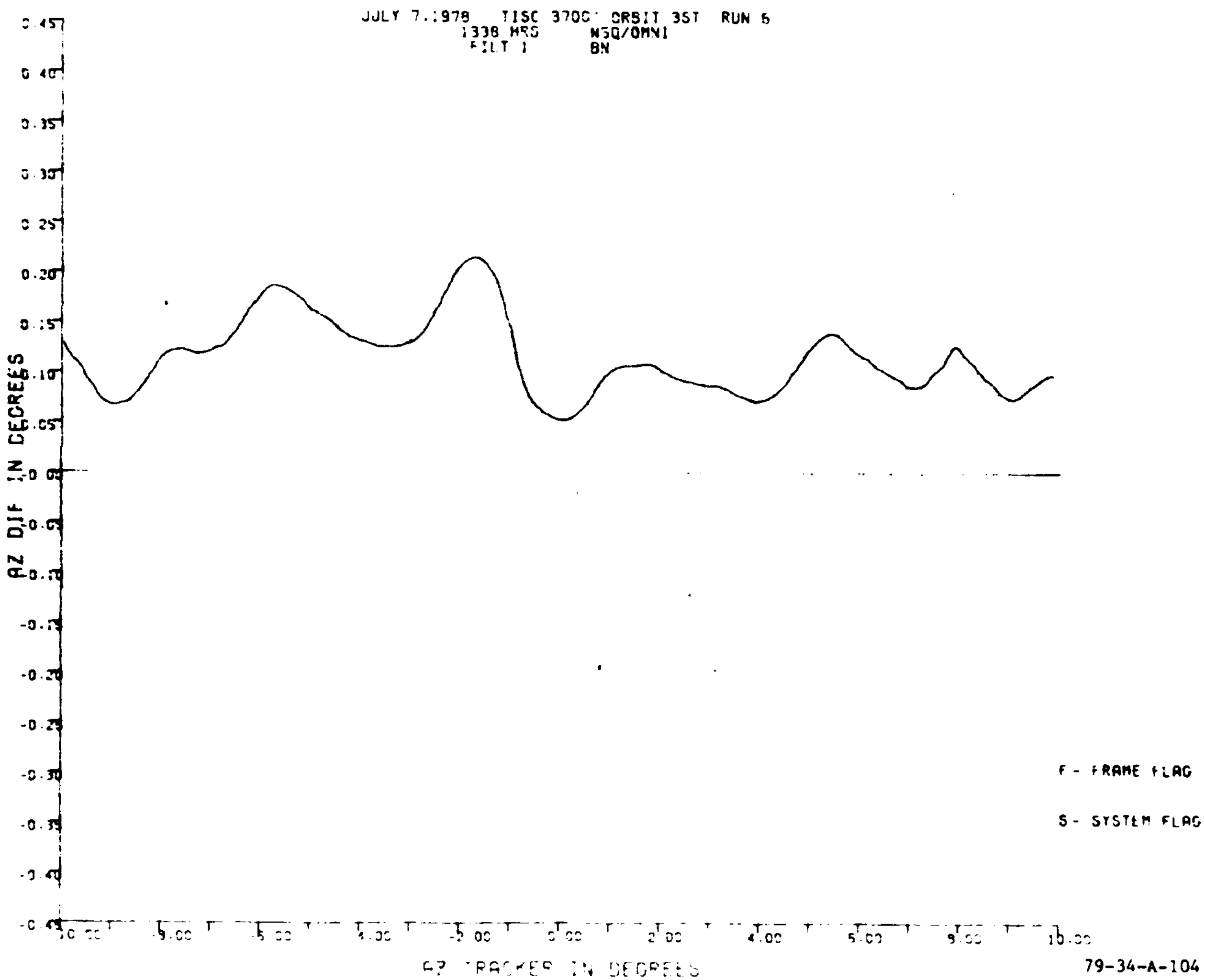

JULY 7.1978 TISC 2200 ORBIT 3ST RUN 5
1330 HRS NSO/OMNI
FILT 1 BN
EL DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-101


JULY 7.1978 TISC 2200' ORBIT 3ST RUN 5
1330 HRS NSO/OMNI
FILT 2 BN
EL DIF IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG

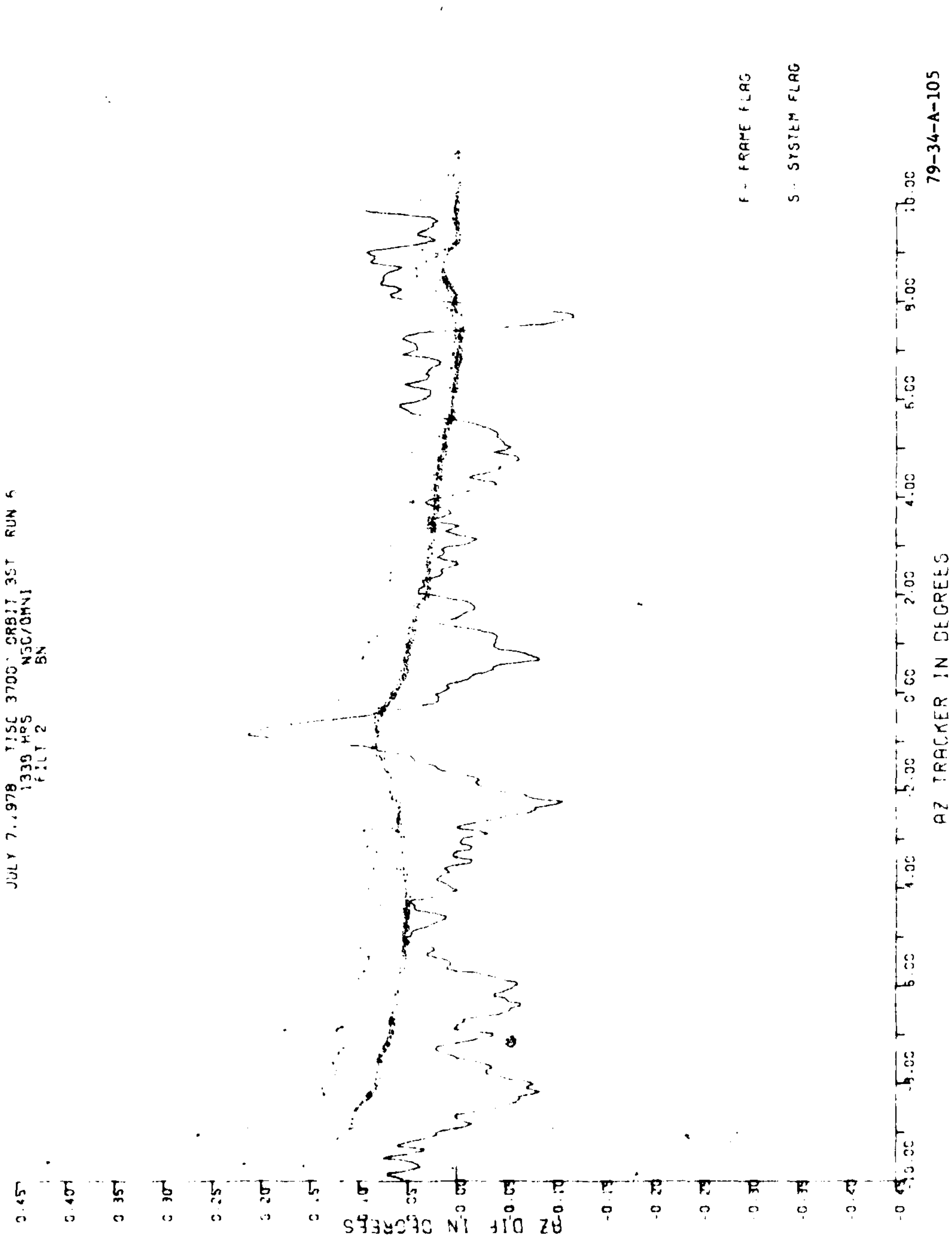


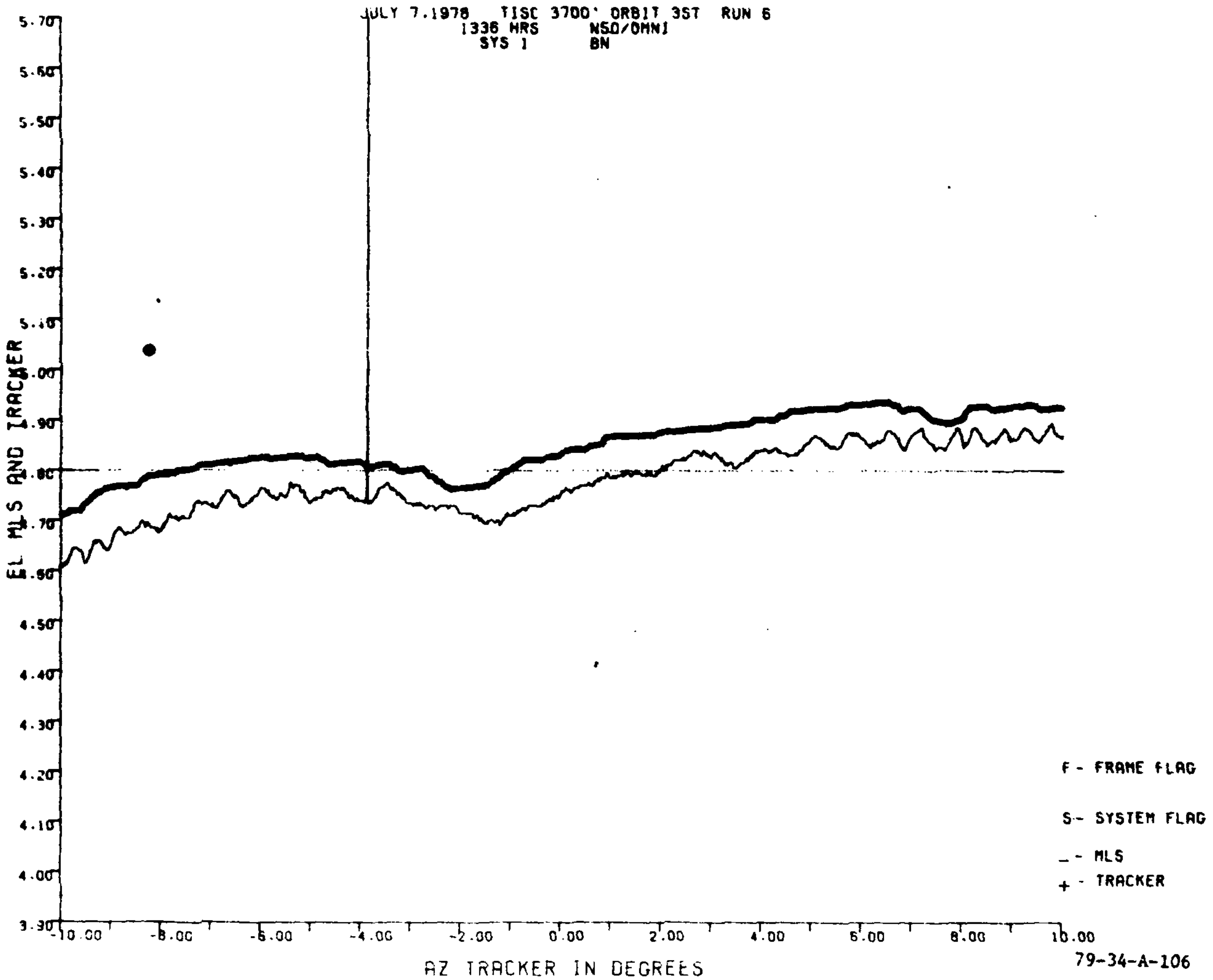
JULY 7, 1978 TISC 3700 ORBIT 357 RUN 6
1335 HRS NSD/OMNI
SYS 1 BN
AZ MLS AND TRACKER
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
- MLS
+ TRACKER

79-34-A-103

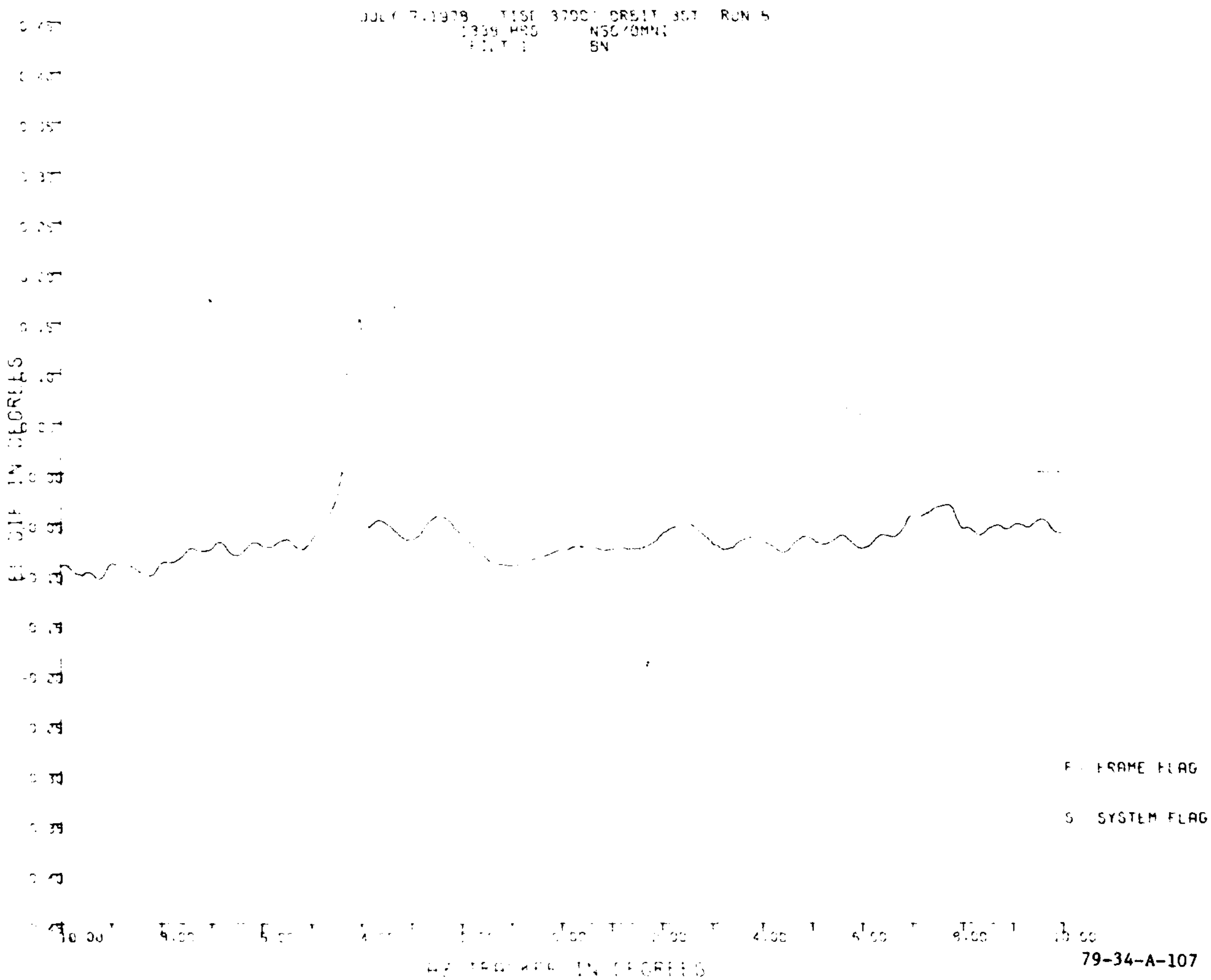

JULY 7,1978 TISC 3700 ORBIT 35T RUN 6
1338 HRS N5Q/OMNI
FILT 1 BN
AZ DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-104

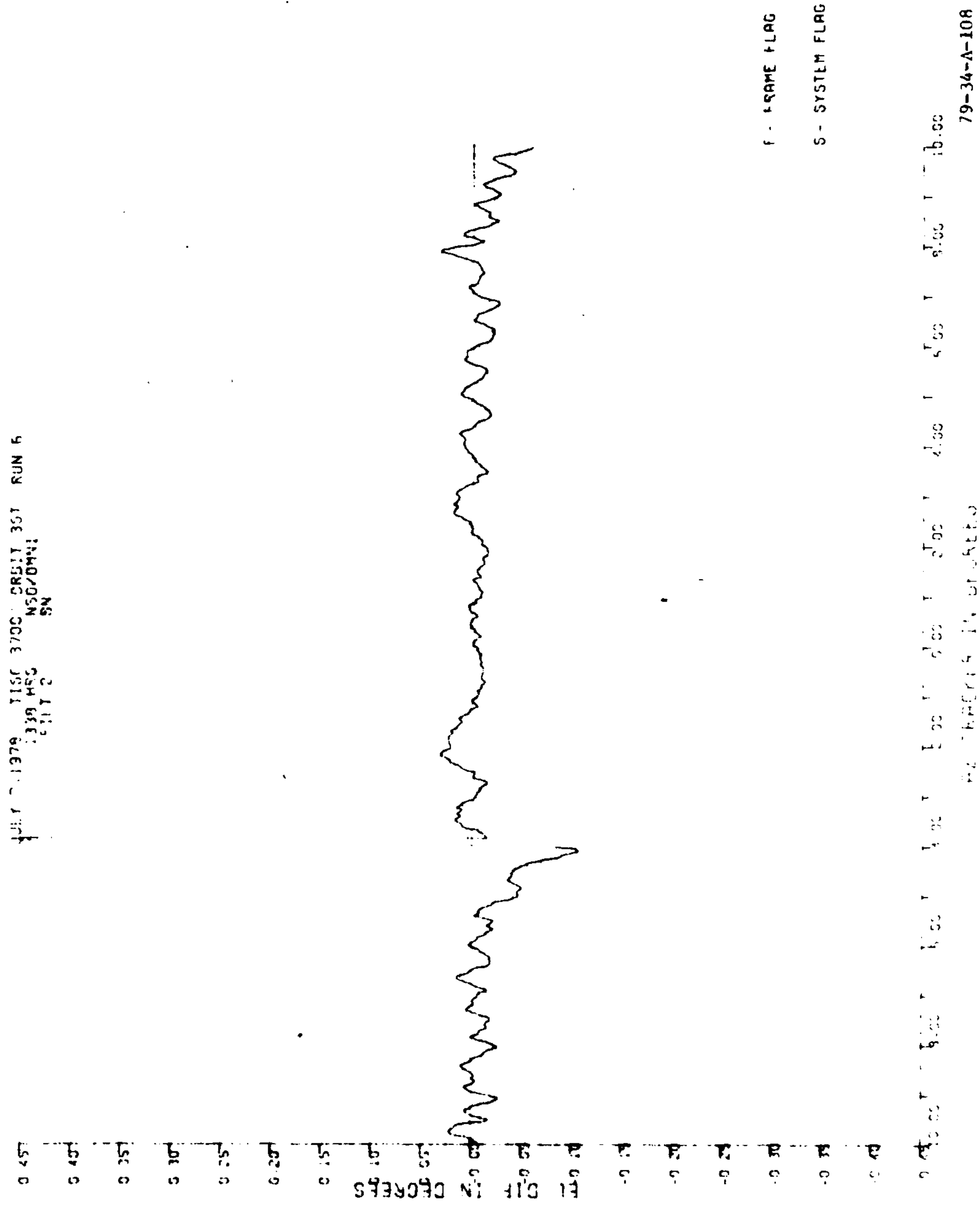

JULY 7, 1978 TISC 3700' ORBIT 35T RUN 6
1339 HRS NSC/OMNI
FILT 2 BN
F - FRAME FLAG
S - SYSTEM FLAG
AZ TRACKER IN DEGREES
AZ DIF IN DEGREES
79-34-A-105

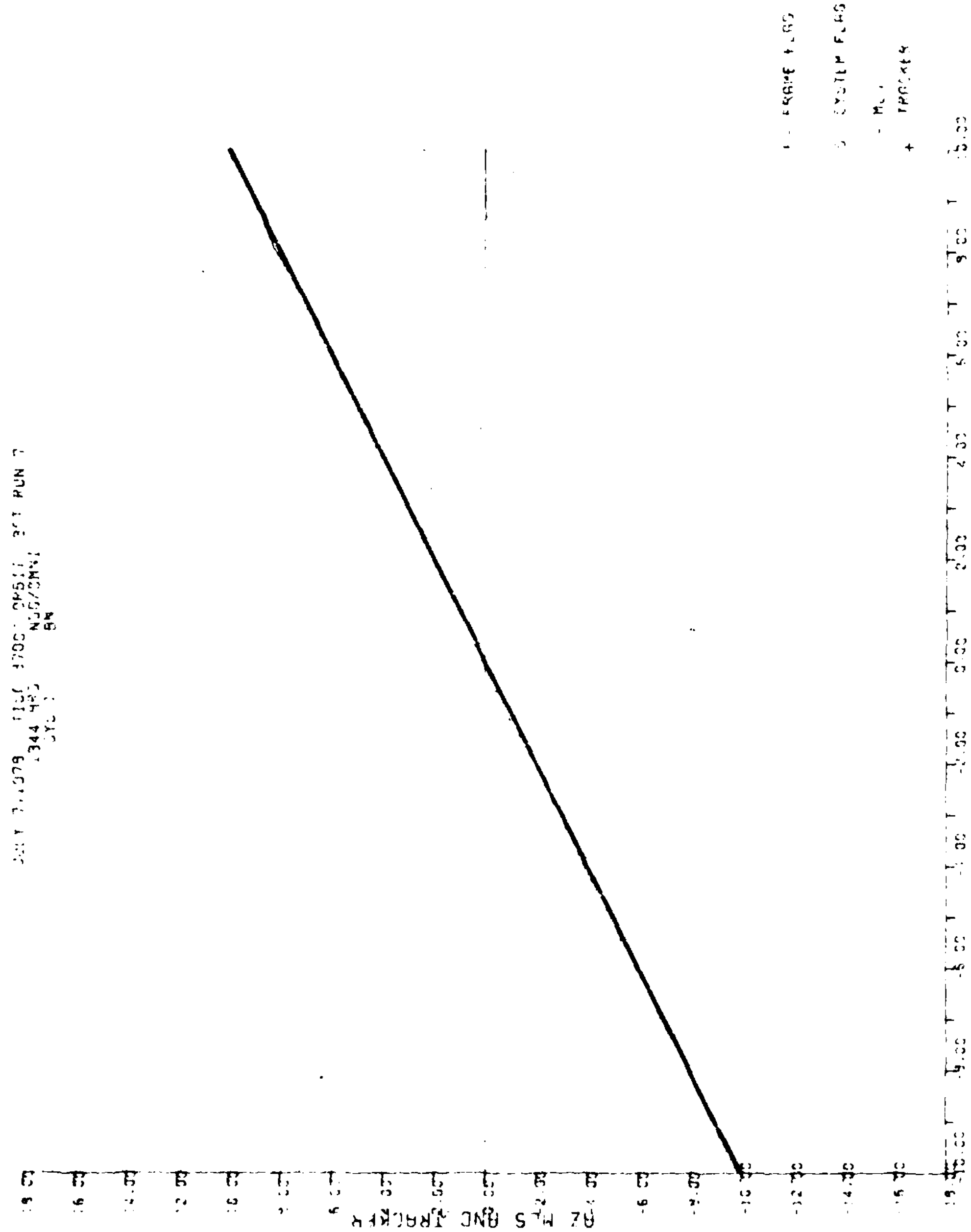

JULY 7,1978 TISC 3700' ORBIT 3ST RUN 6
1336 HRS NSO/OMNI
SYS 1 BN
EL MLS AND TRACKER
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
_ - MLS
+ - TRACKER

79-34-A-106

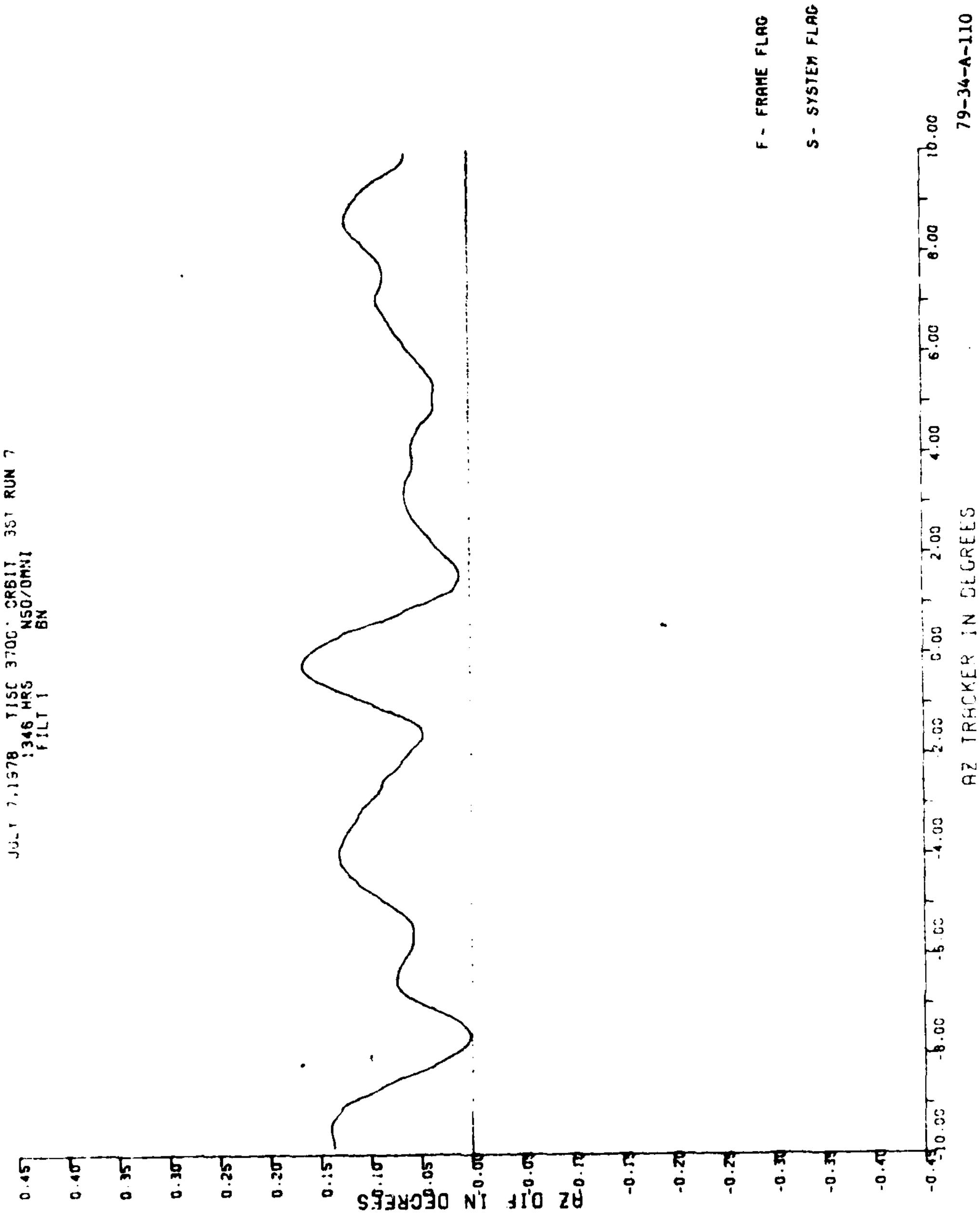


79-34-A-107

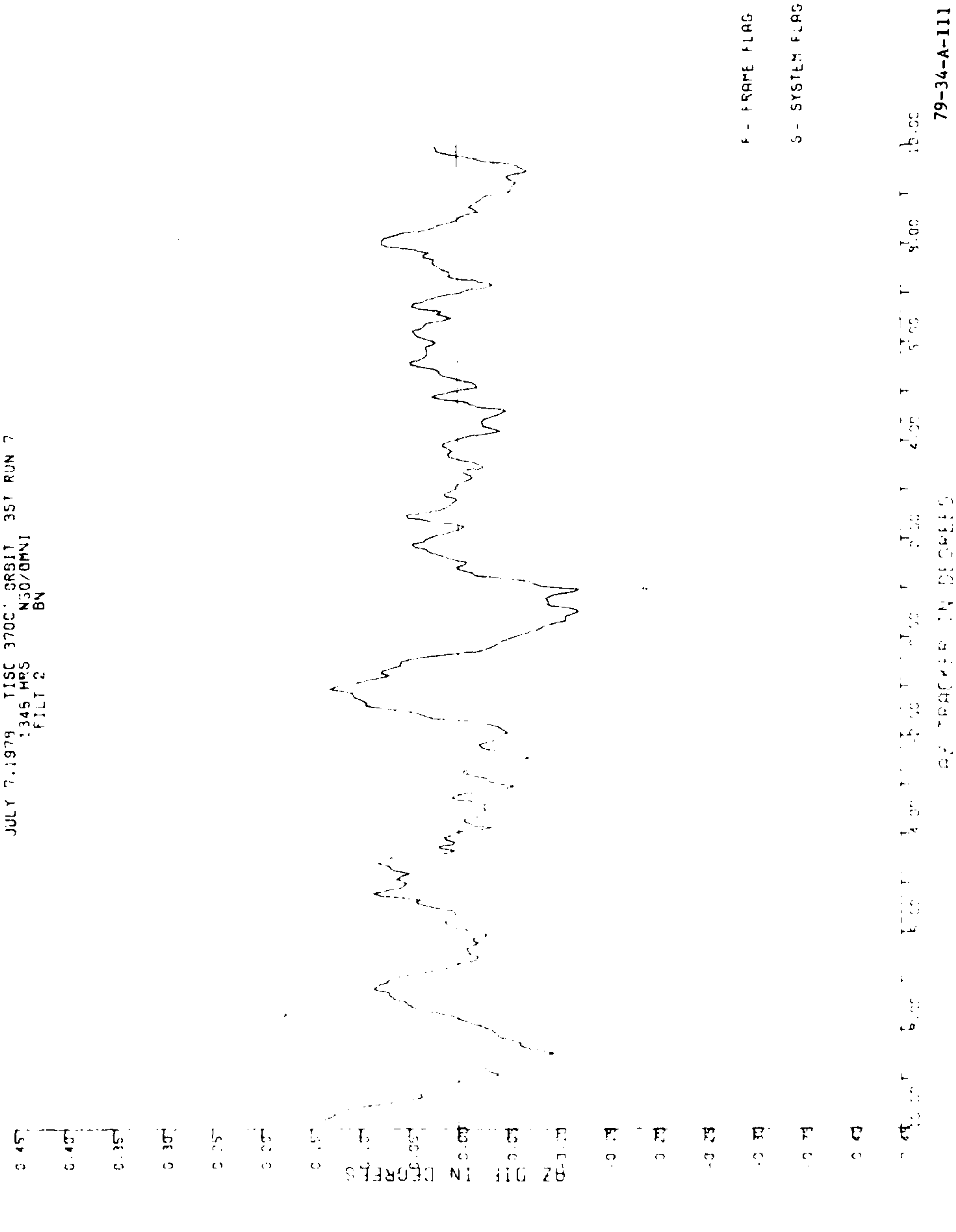

F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-108

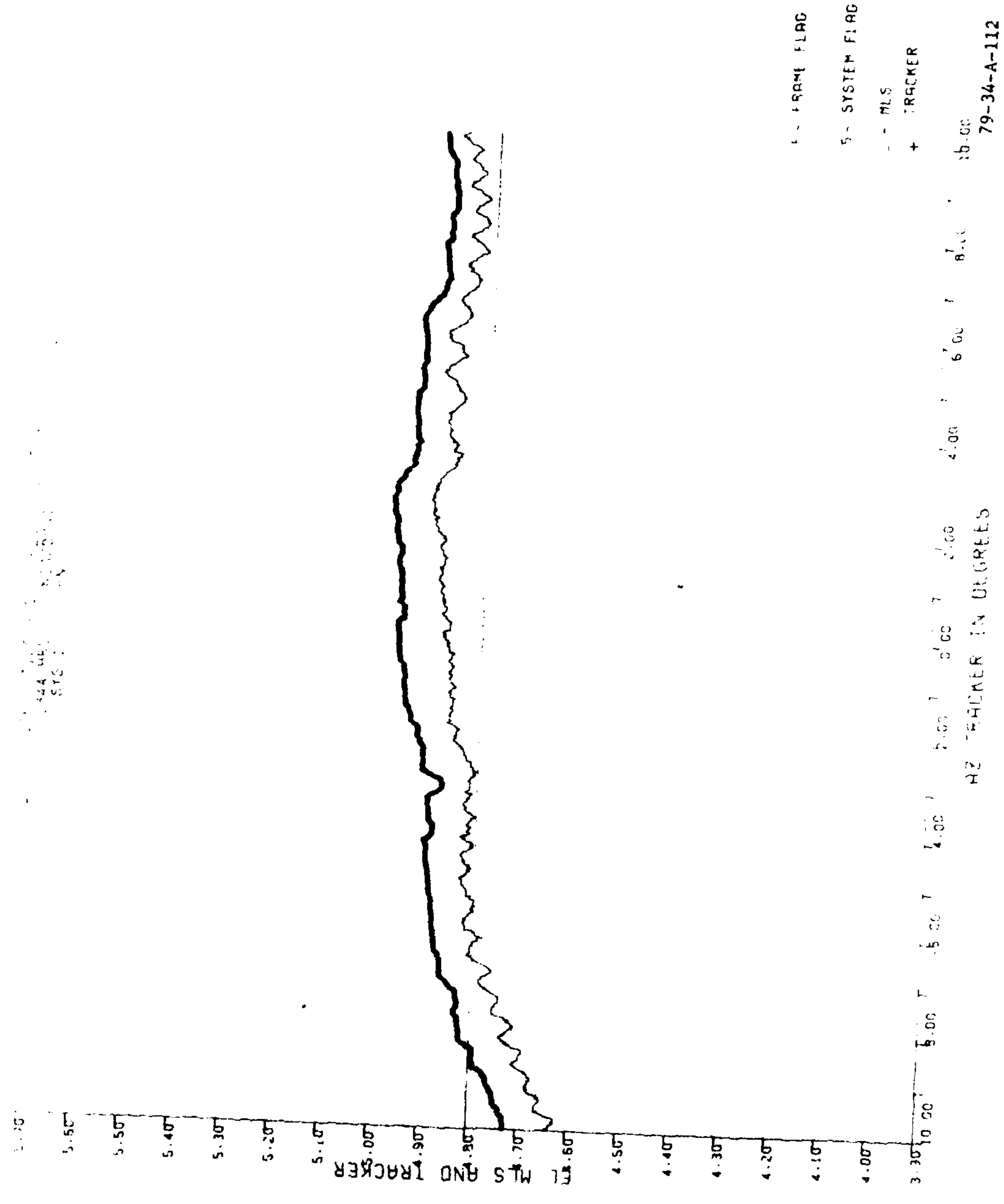

1344 HRS
AZ MLS AND TRACKER
AZ TRACKER IN DEGREES
FRAME FLAG
SYSTEM FLAG
TRACKER

79-34-A-109

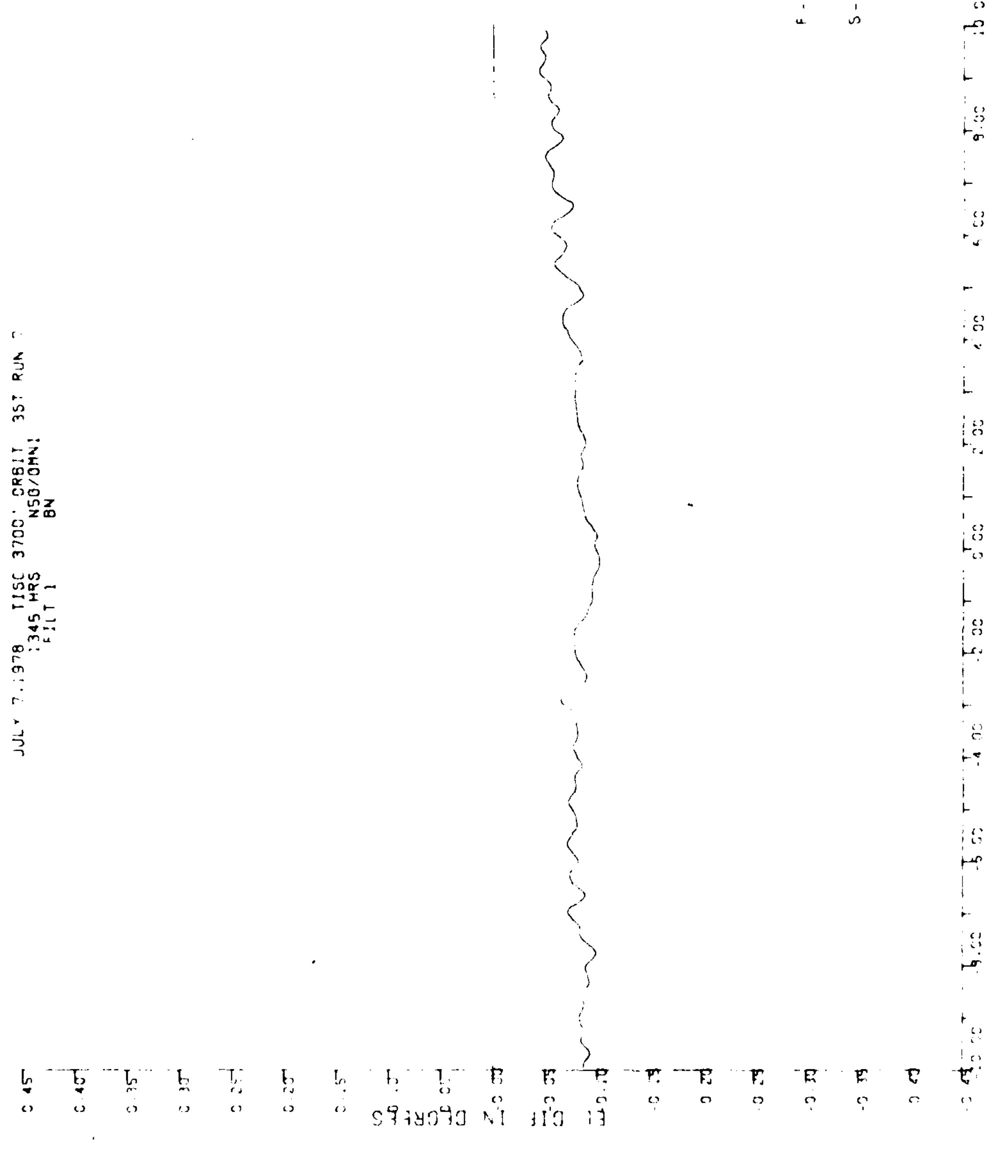


JULY 7,1978 TISE 3700' ORBIT 351 RUN 7
1346 HRS NSO/OMNI
FILT 1 BN
AZ DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-110

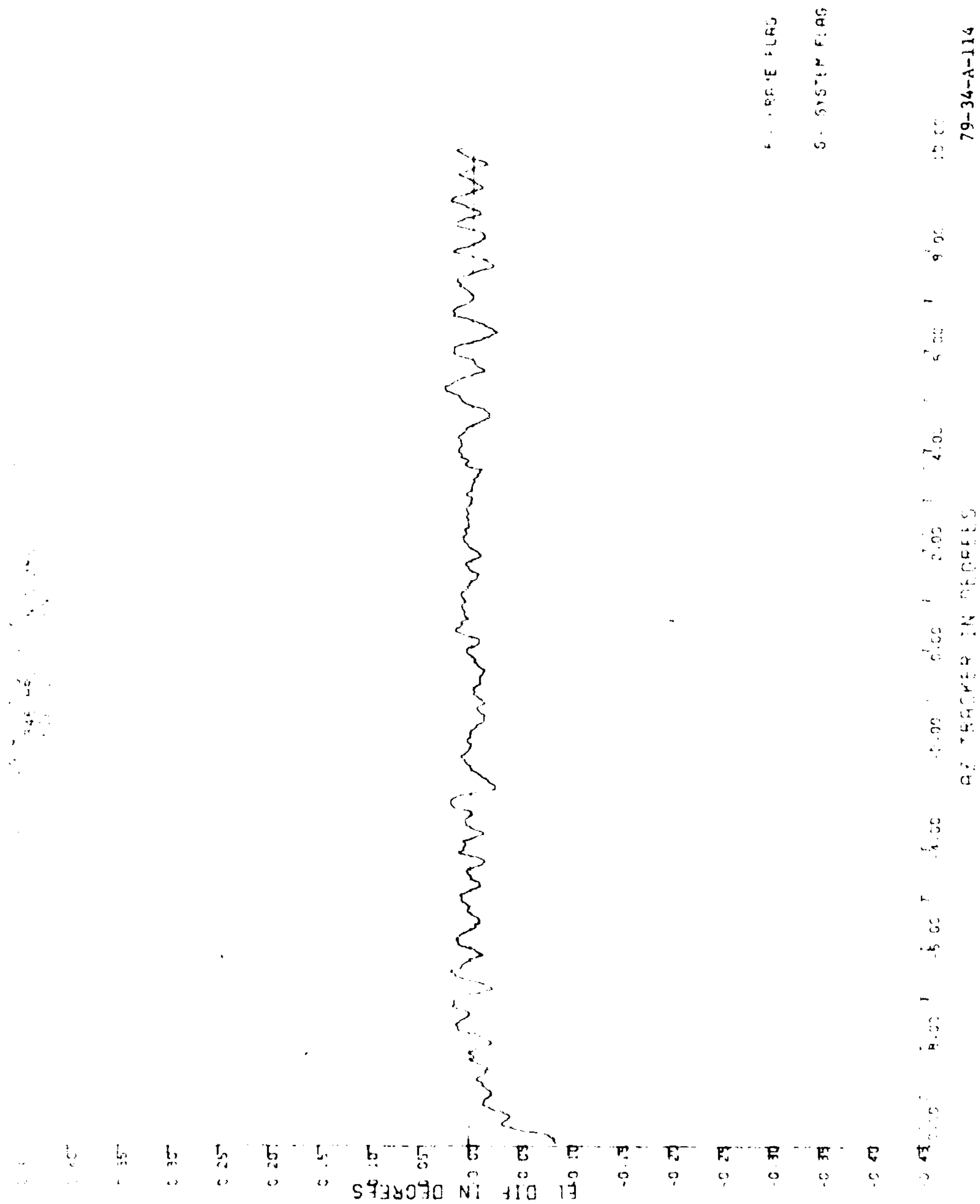

JULY 7,1979 TISC 370C ORBIT 357 RUN 7
1345 HRS N30/OMNI
FILT 2 BN
AZ DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-111

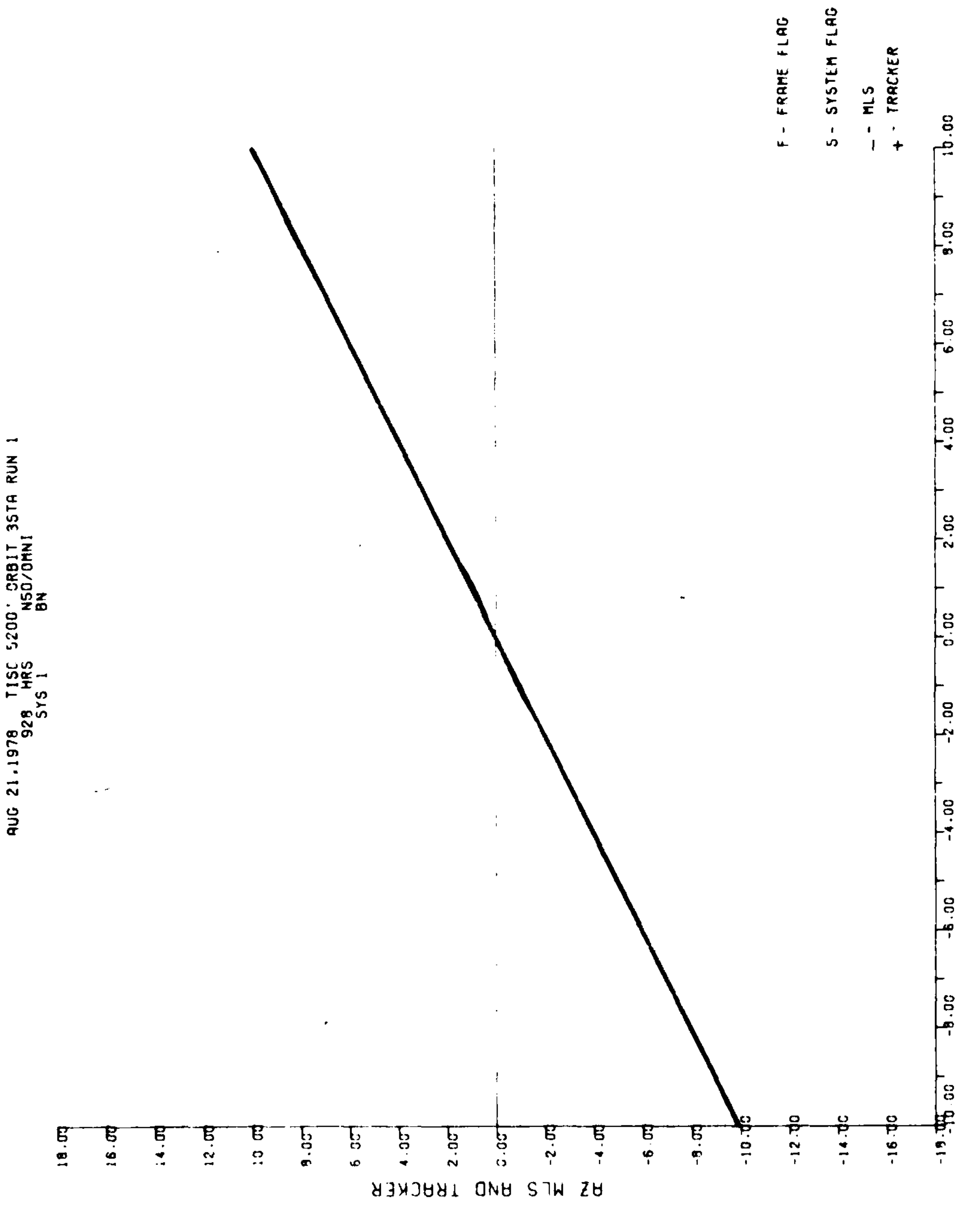


EL MLS AND TRACKER
AZ TRACKER IN DEGREES
SYSTEM FLAG
MLS
TRACKER
79-34-A-112

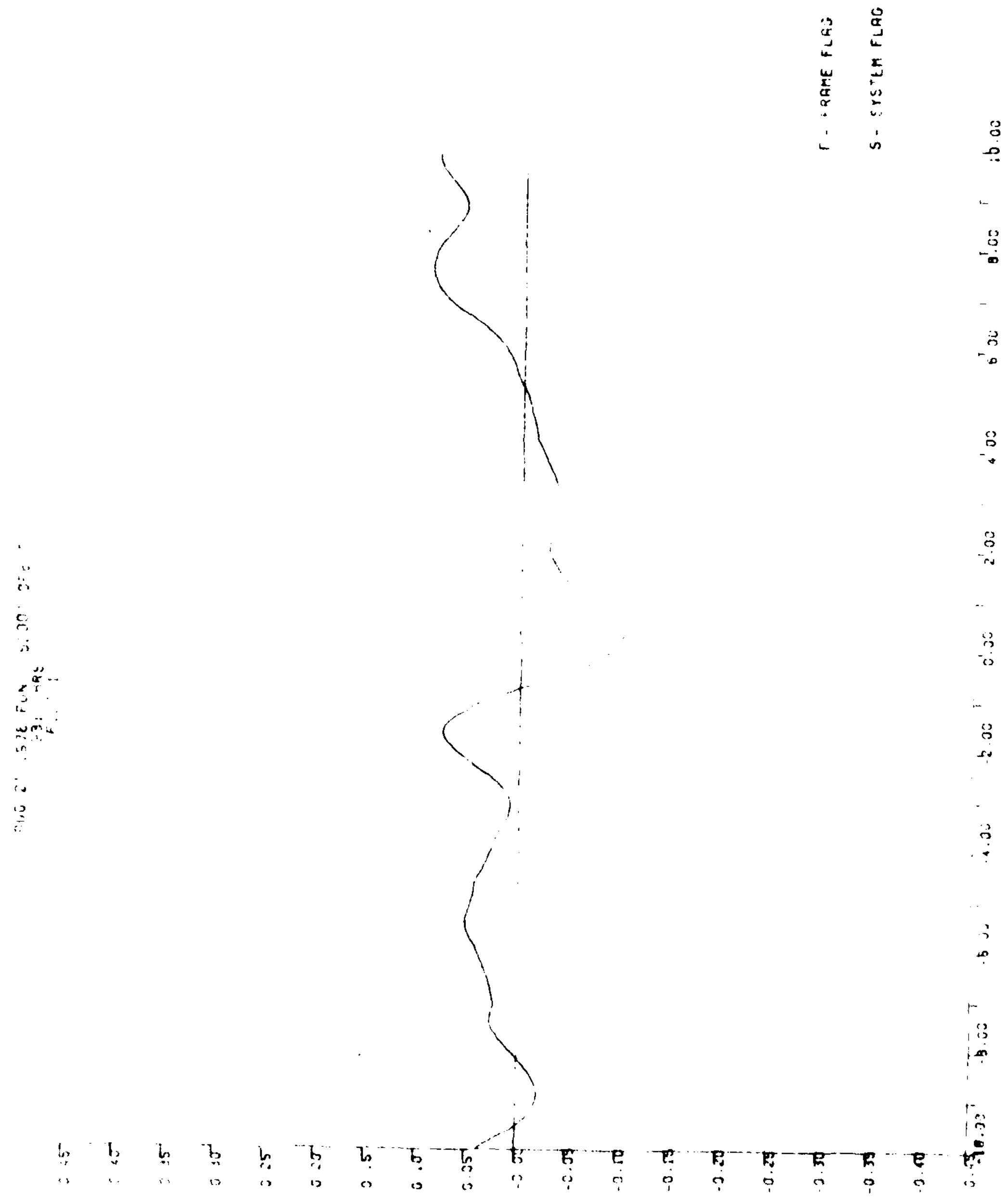

JULY 7, 1978 TISC 3700' ORBIT 357 RUN
1345 HRS N50/OMNI
FILT 1 BN
EL DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-113

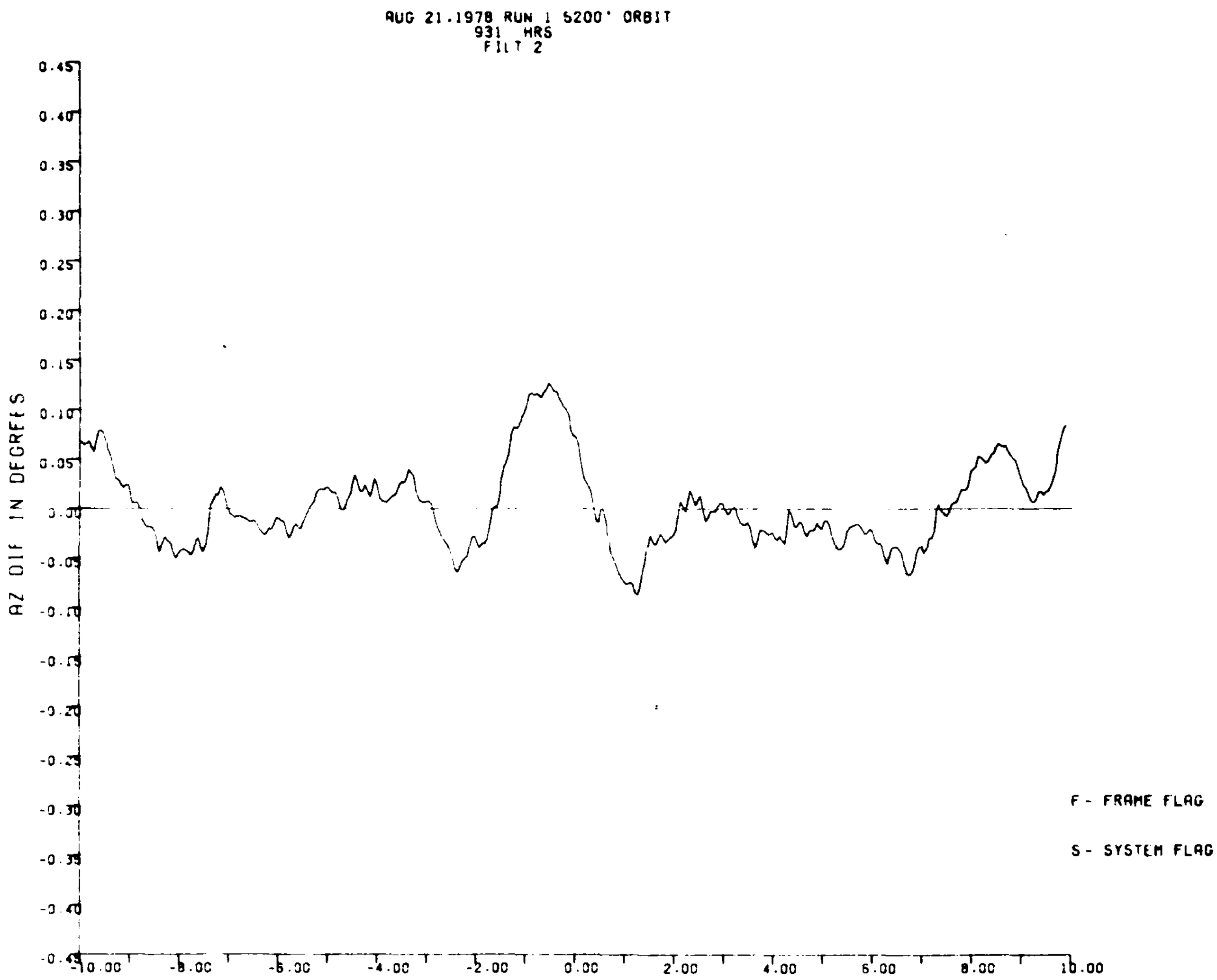

EL DIF IN DEGREES
AZ TRACKER IN DEGREES
S - SYSTEM FLAG
79-34-A-114


AUG 21,1978 TISC 5200' ORBIT 35TA RUN 1
928 HRS NSO/OMNI
SYS 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
— - MLS
+ - TRACKER
AZ MLS AND TRACKER
AZ TRACKER IN DEGREES

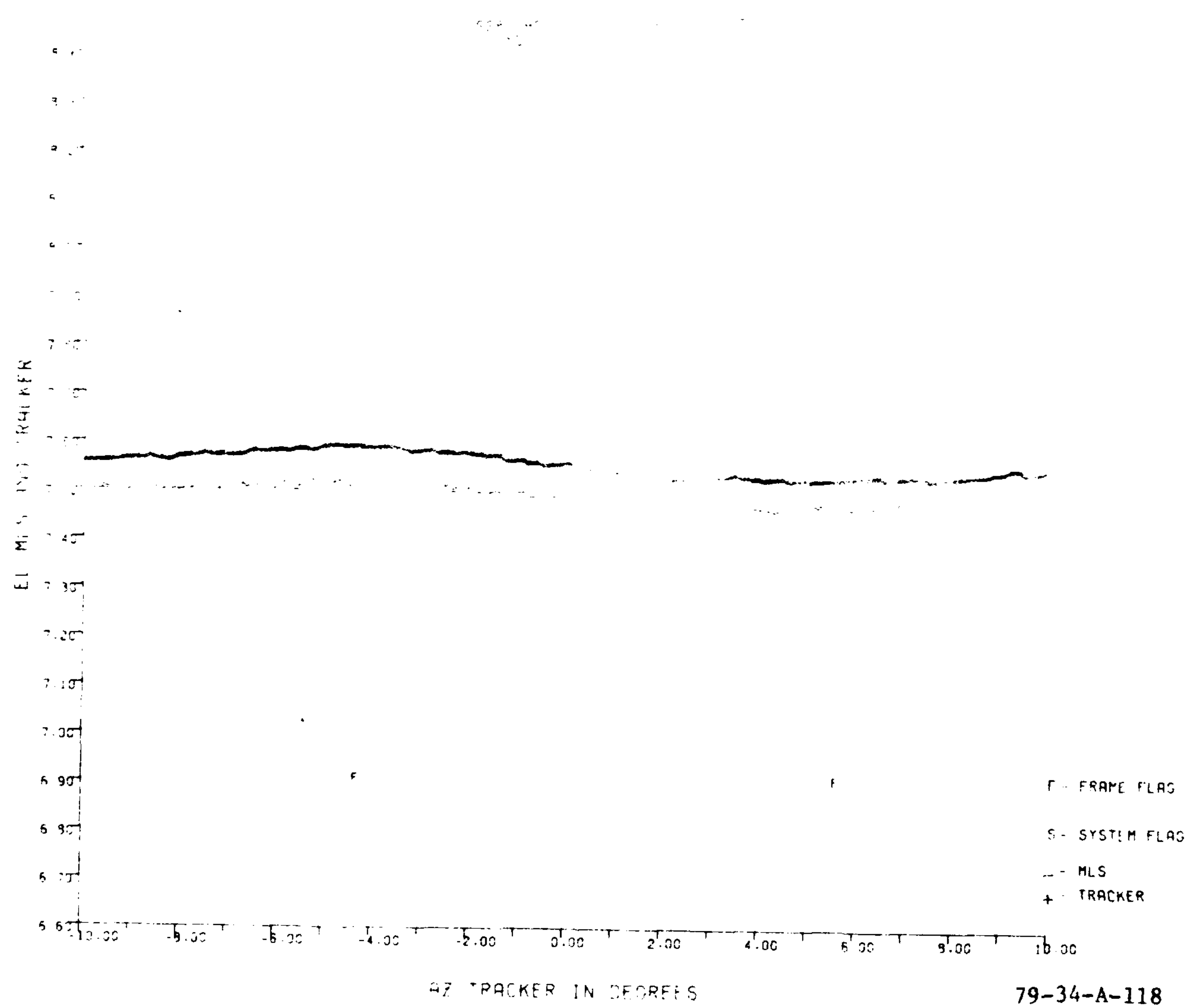
79-34-A-115


F - FRAME FLAG
S - SYSTEM FLAG
AZ TRACKER IN DEGREES
AZ DIF IN DEGREES

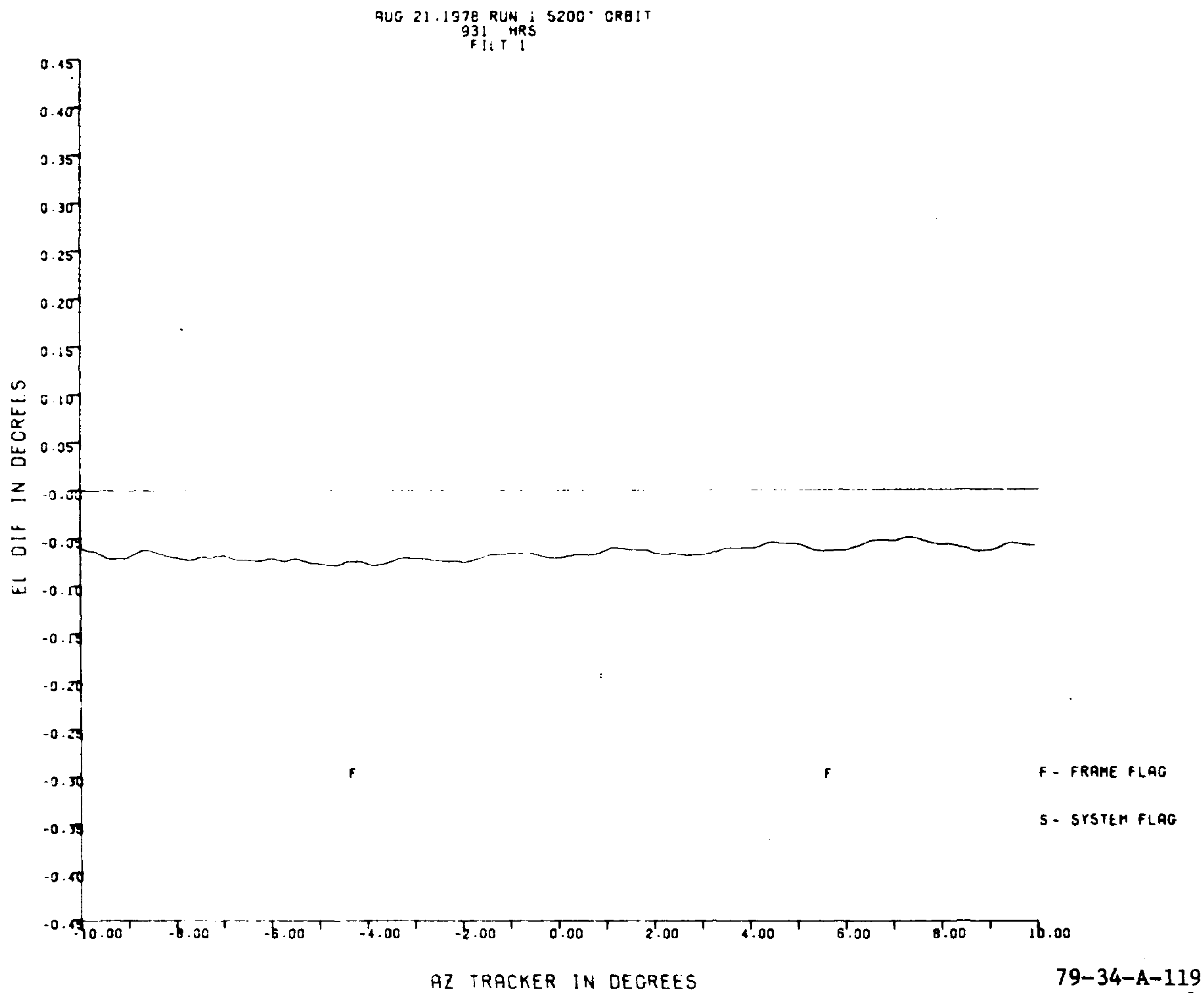
79-34-A-116


AUG 21.1978 RUN 1 5200' ORBIT
931 HRS
FILT 2
AZ DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG

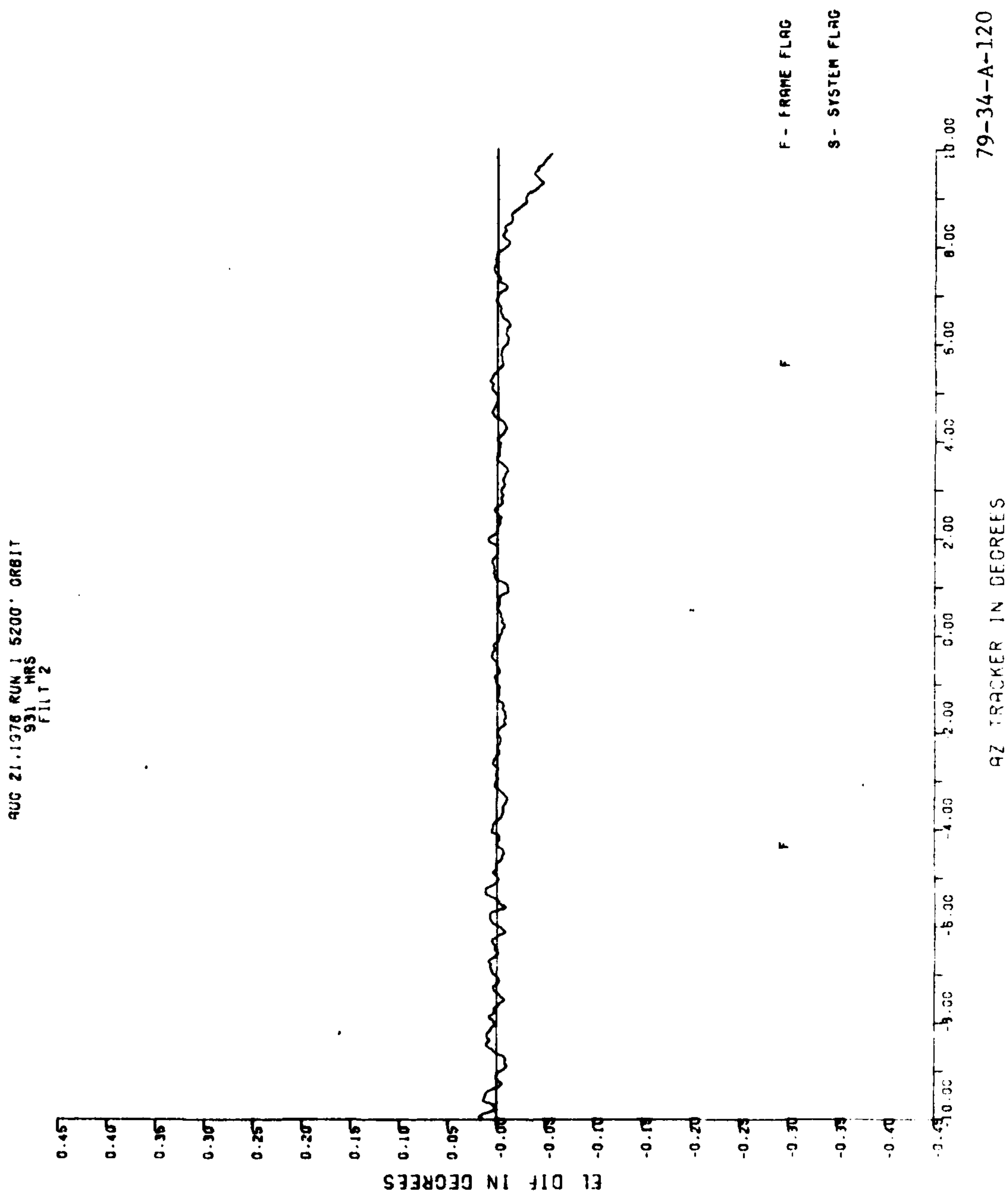
79-34-A-117

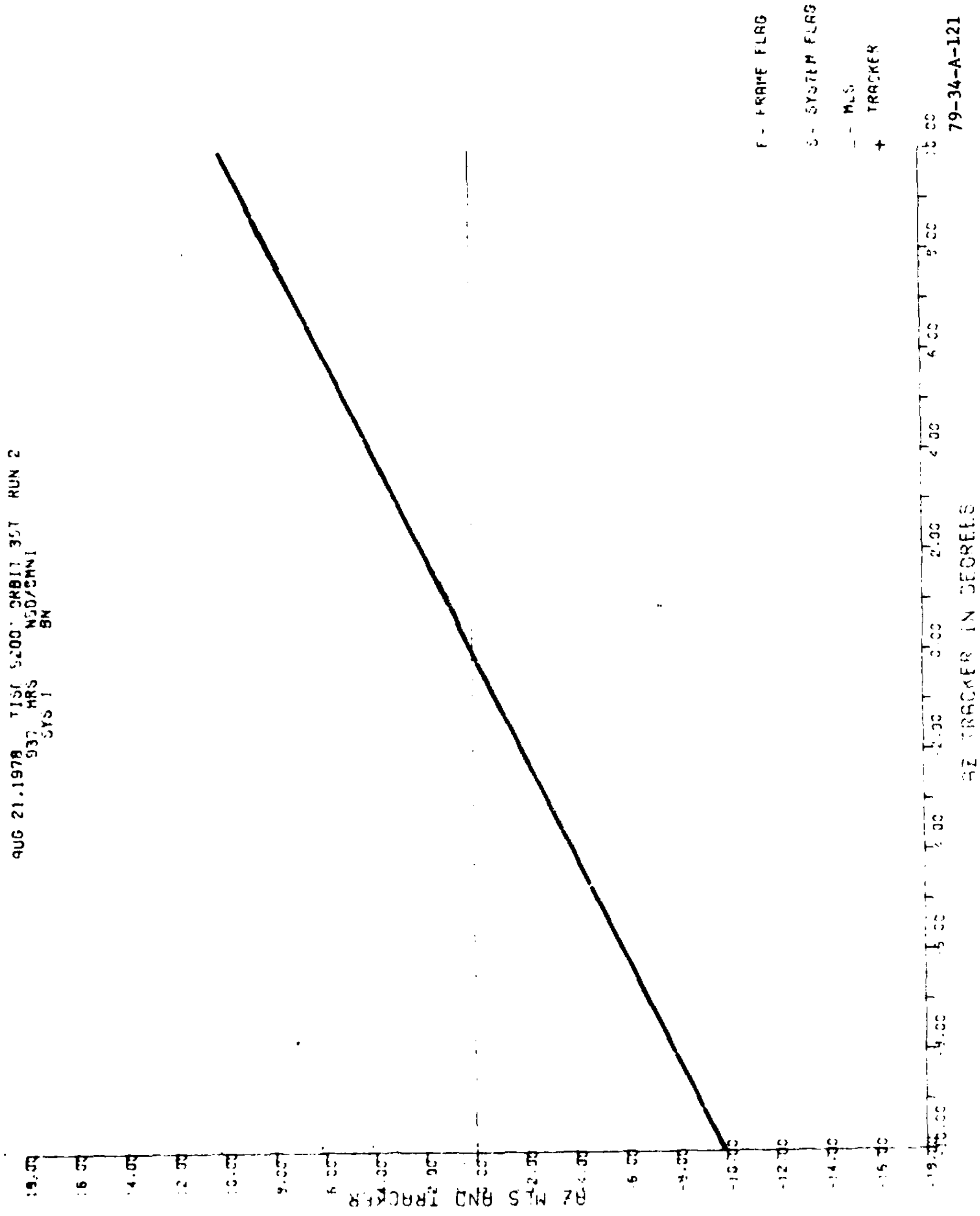

EL MLS AND TRACKER
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
- MLS
+ - TRACKER

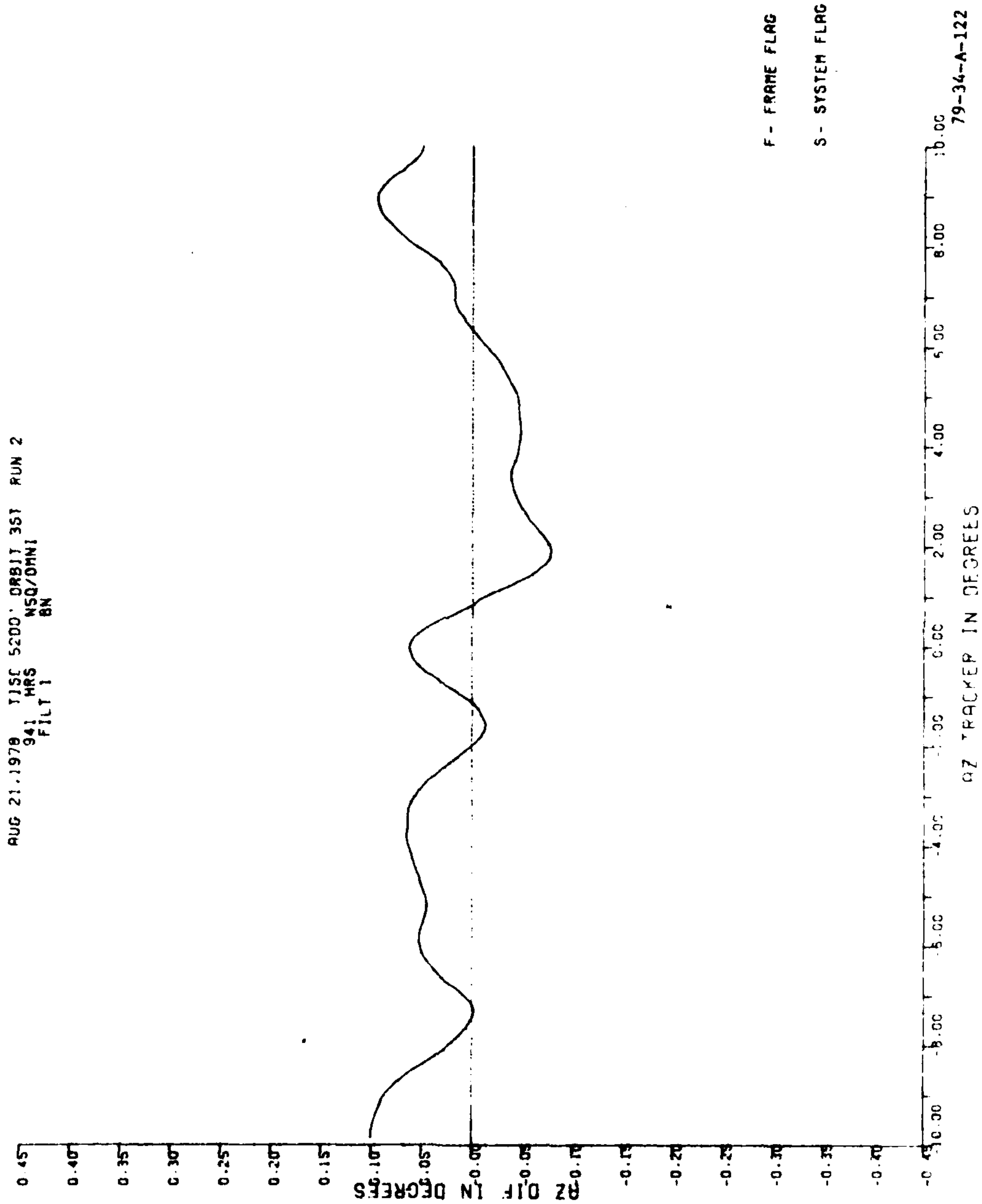
79-34-A-118

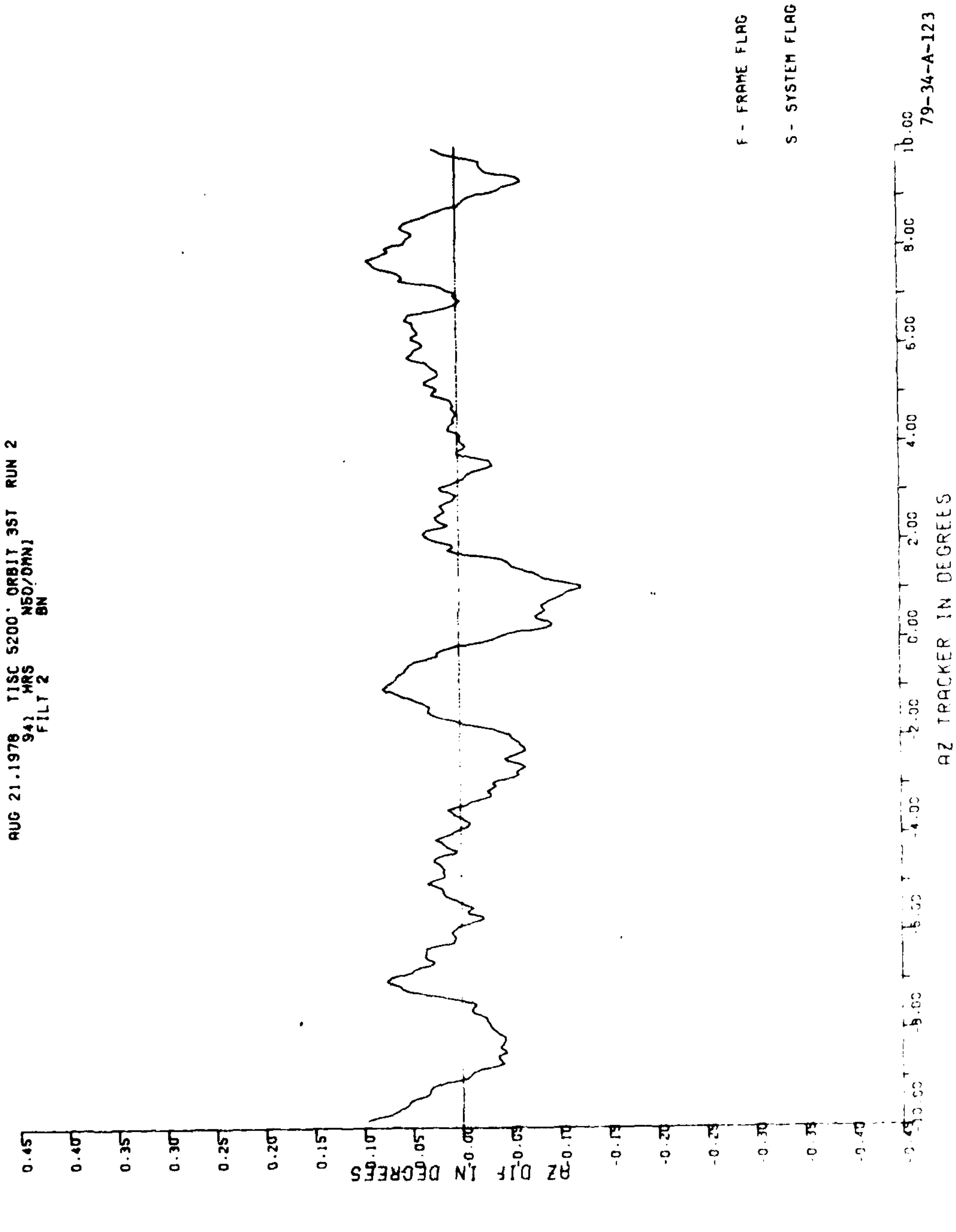

AUG 21.1978 RUN 1 5200' ORBIT
931 HRS
FILT 1
EL DIF IN DEGREES
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
AZ TRACKER IN DEGREES
F
F
F - FRAME FLAG
S - SYSTEM FLAG

79-34-A-119

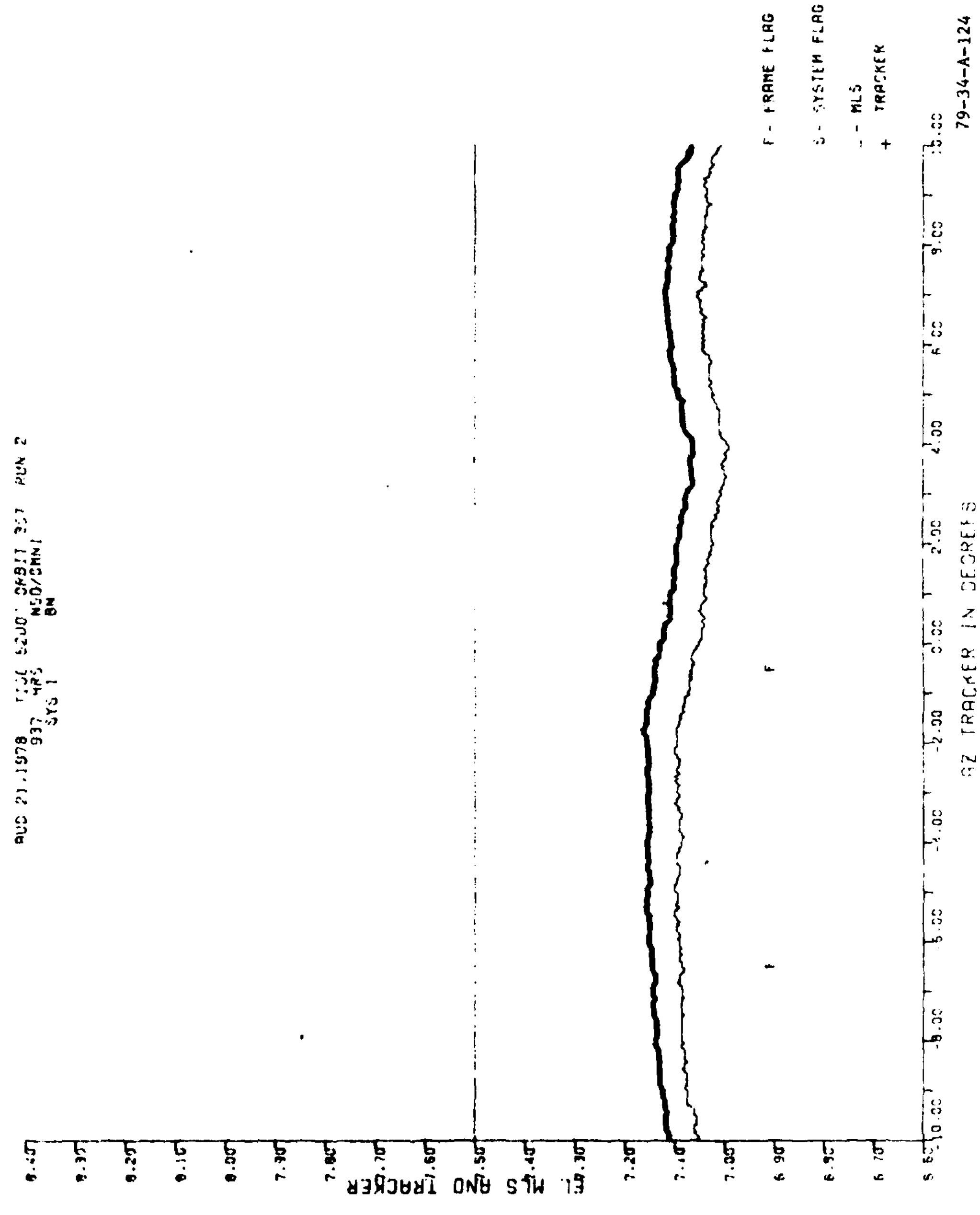

AUG 21.1978 RUN 1 5200' ORBIT
931 MRS
FILT 2
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-120
AZ TRACKER IN DEGREES
EL DIF IN DEGREES

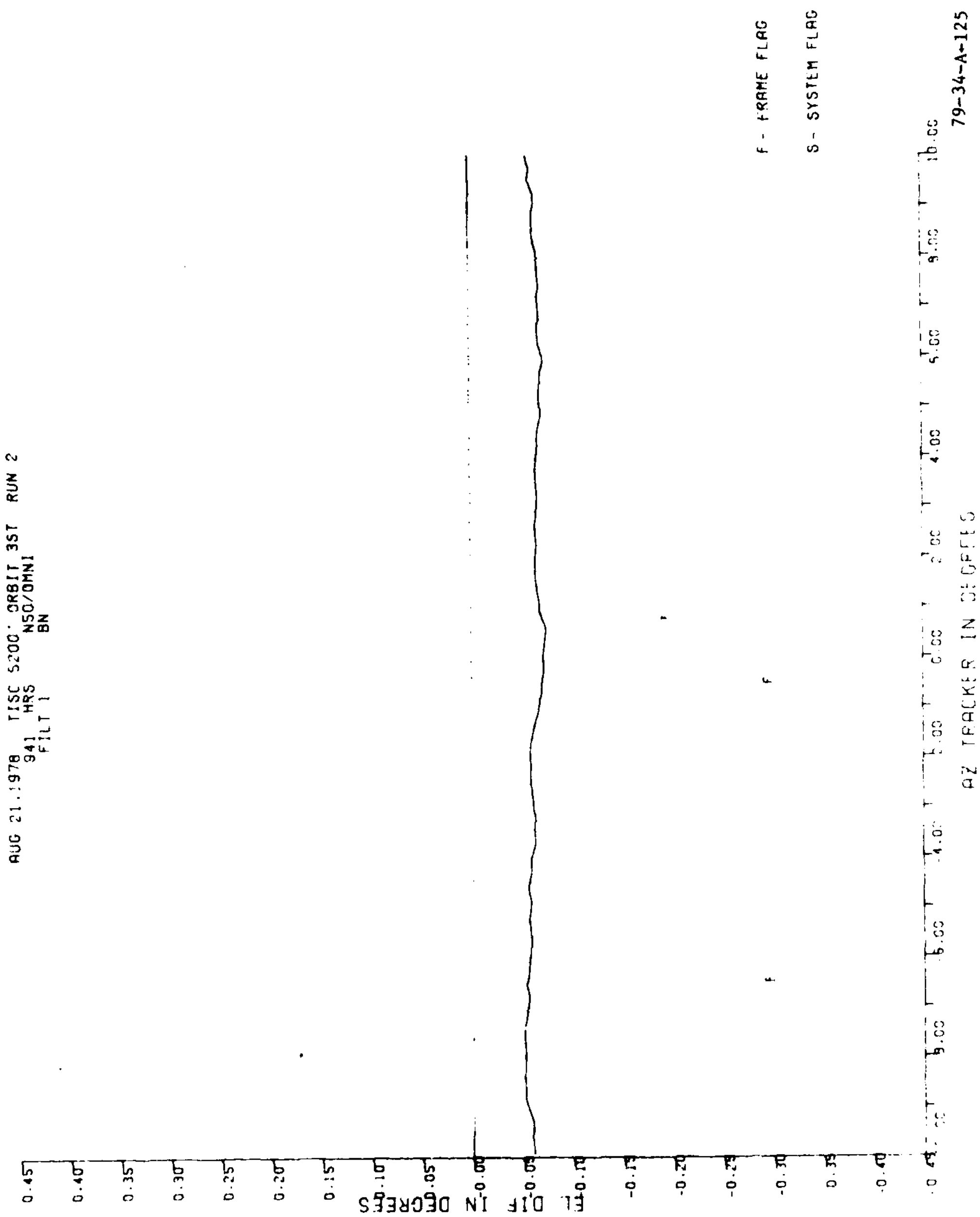

AUG 21.1978 TISC 5200' ORBIT 35T RUN 2
937 HRS NSD/OMNI
SYS 1 BN
AZ MLS AND TRACKER
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
_ - MLS
+ TRACKER
79-34-A-121

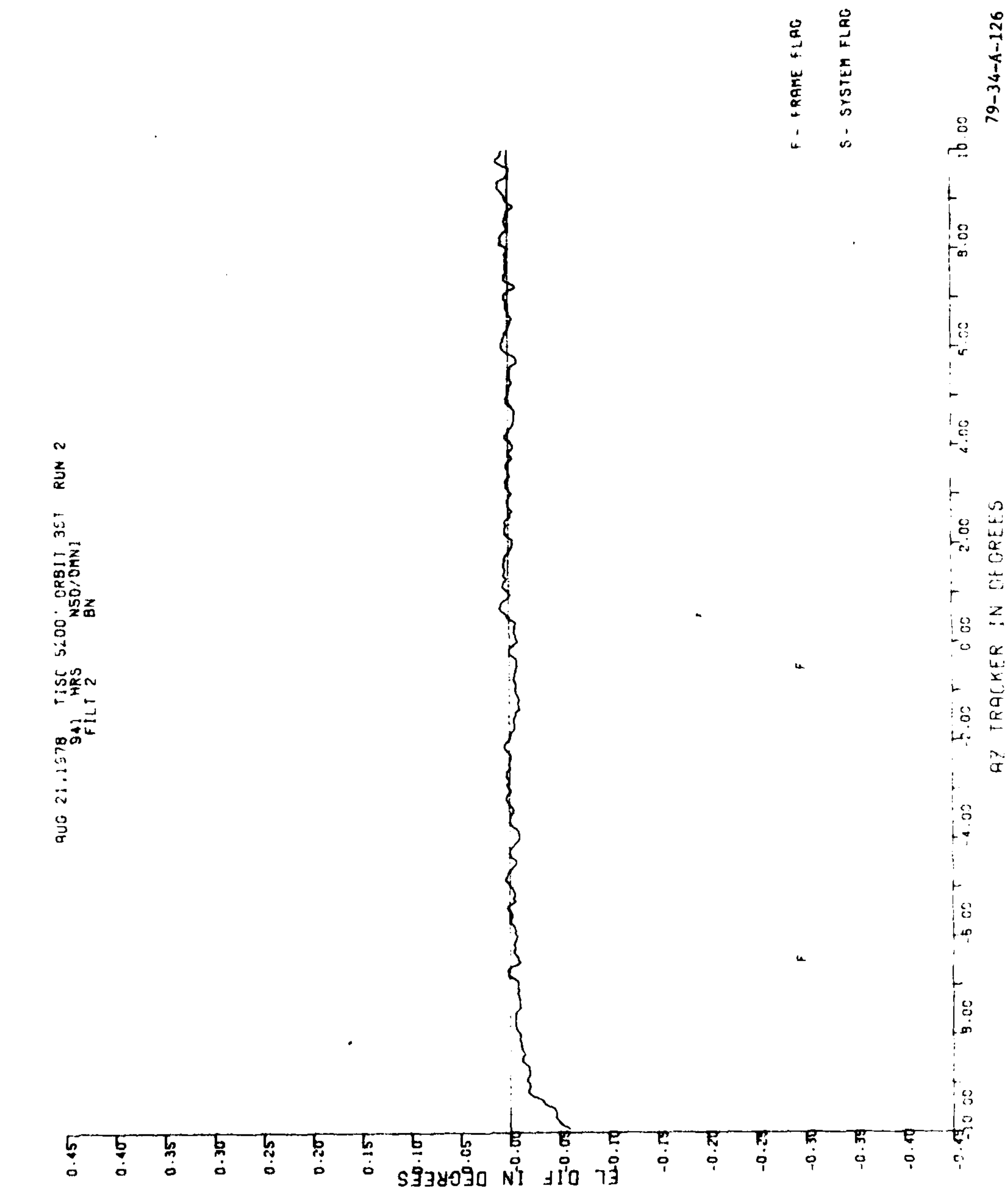

AUG 21,1978 TISC 5200' ORBIT 357 RUN 2
941 HRS NSQ/OMNI
FILT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-122
AZ TRACKER IN DEGREES
AZ DIF IN DEGREES



AUG 21.1978 TISC 5200' ORBIT 3ST RUN 2
941 HRS N50/OMNI
FILT 2 BN
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-123
AZ TRACKER IN DEGREES
AZ DIF IN DEGREES
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-0.45


EL MLS AND TRACKER
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
- - MLS
+ TRACKER
79-34-A-124


AUG 21.1978 TISC 5200' ORBIT 35T RUN 2
941 HRS NSO/OMNI
FILT 1 BN
F - FRAME FLAG
S - SYSTEM FLAG
AZ TRACKER IN DEGREES
EL DIF IN DEGREES
79-34-A-125


AUG 21,1978 TISC 5200' ORBIT 3ST RUN 2
941 HRS NSD/OMNI
FILT 2 BN
F - FRAME FLAG
S - SYSTEM FLAG
79-34-A-126
AZ TRACKER IN DEGREES
EL DIF IN DEGREES

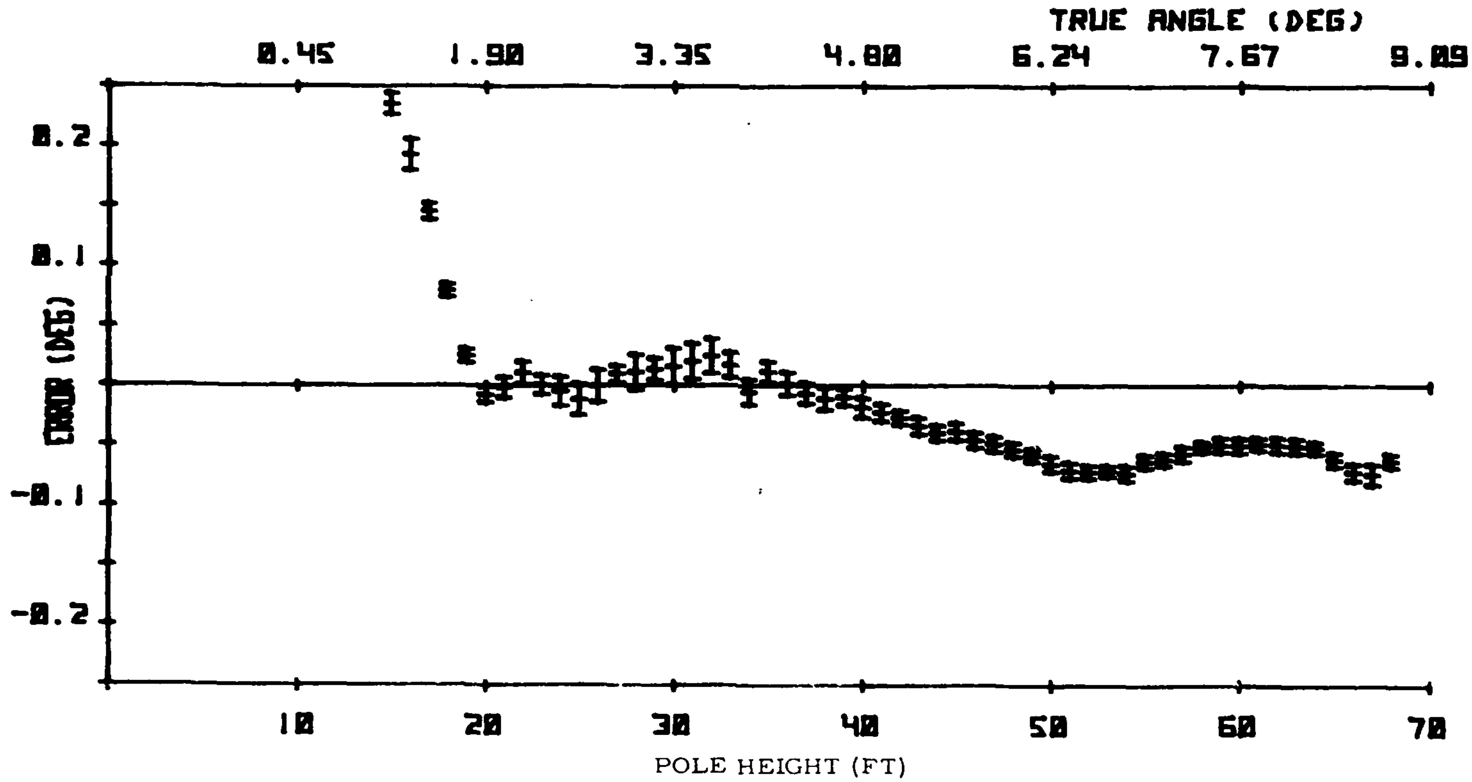
APPENDIX B

STATIC DATA

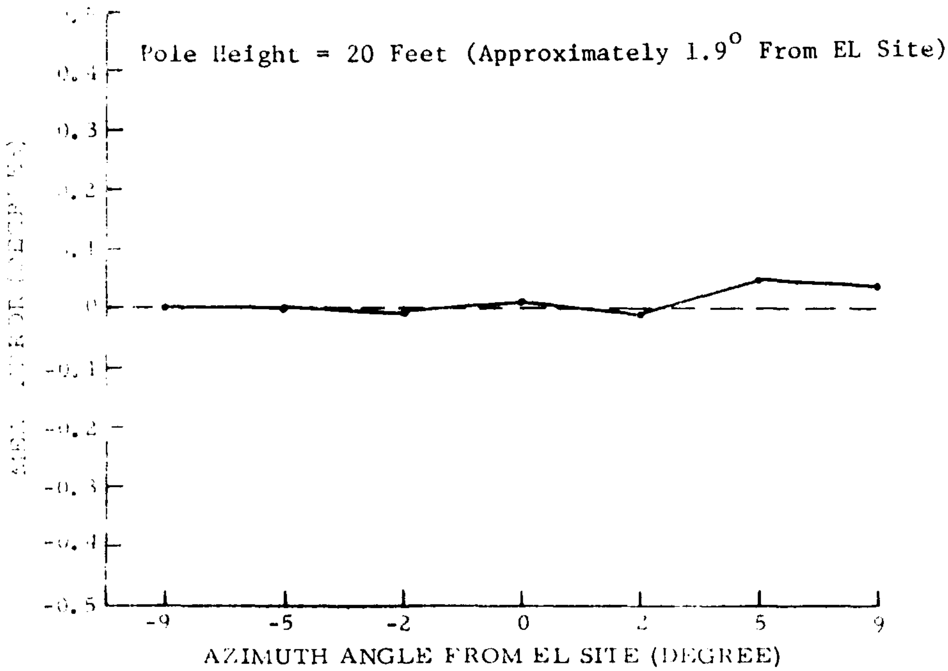
TRSB SMALL COMMUNITY MLS (TI)

ELEVATION STATIC TESTS
VERT CUT AT SURVEY POINT# 7821 6 / 27 / 78
X= 4995.86 Y=-324.73 Z=-10.55

- MEAN & 2 SIGMA ERROR

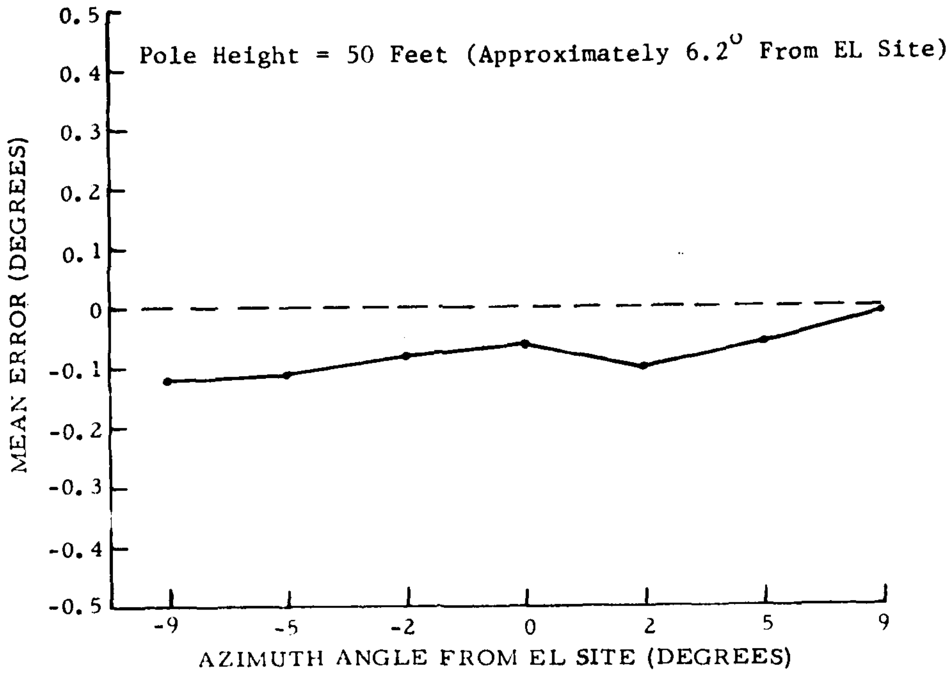


79-34-B-1

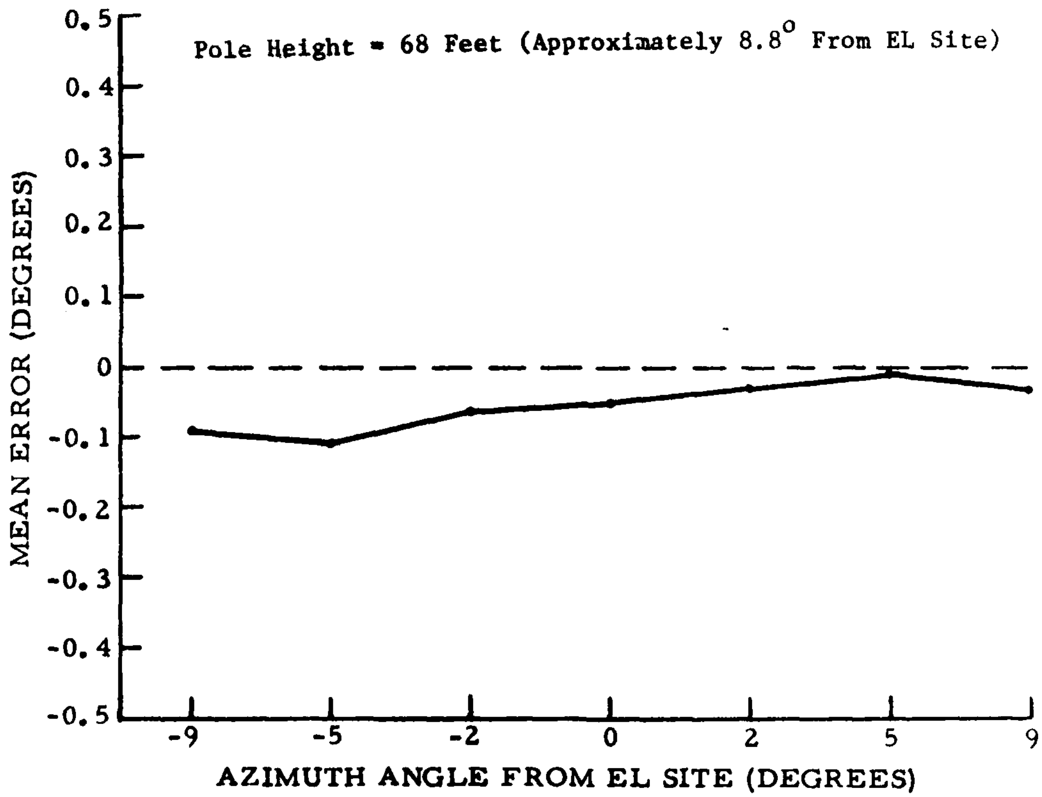


Pole Height = 20 Feet (Approximately 1.9° From EL Site)
0.3
0
-9
-5
-2
0
5
9
AZIMUTH ANGLE FROM EL SITE (DEGREE)

79-34-B-2


Pole Height = 50 Feet (Approximately 6.2° From EL Site)
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
MEAN ERROR (DEGREES)
-9
-5
-2
0
2
5
9
AZIMUTH ANGLE FROM EL SITE (DEGREES)

79-34-B-3



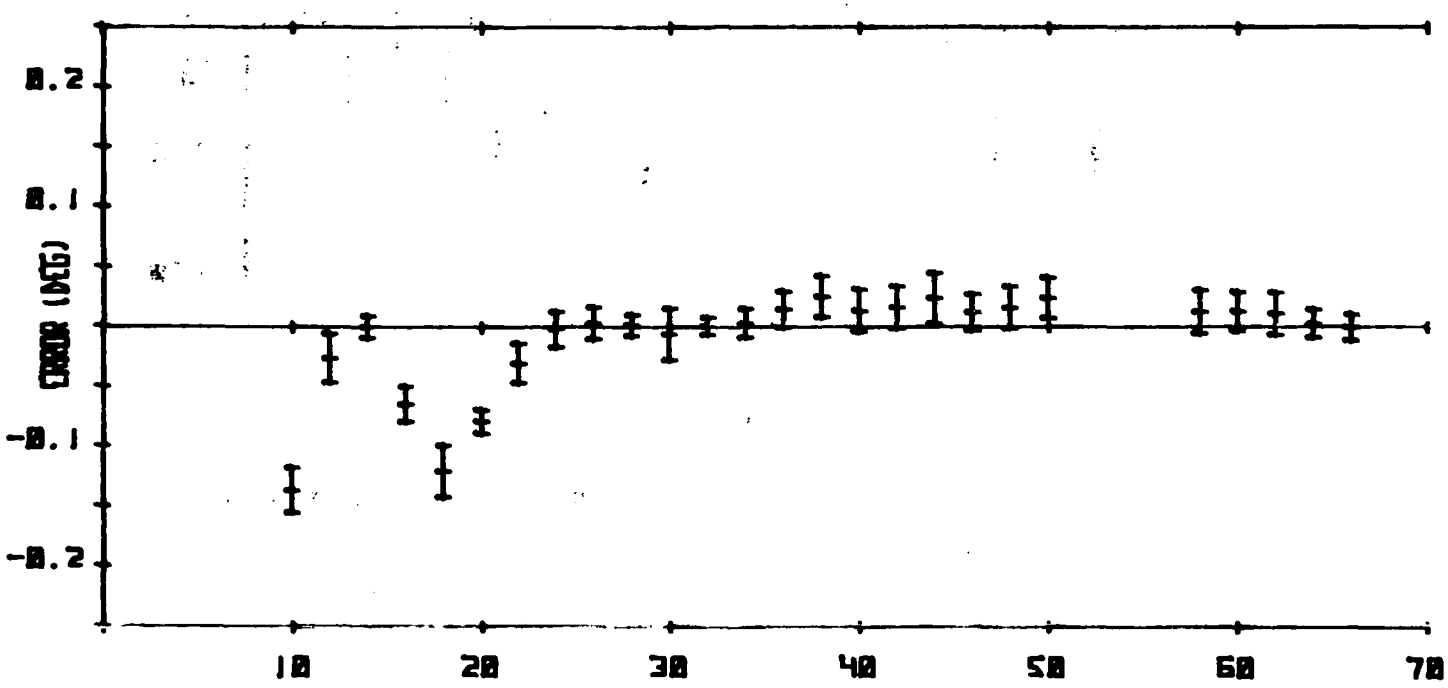
Pole Height = 68 Feet (Approximately 8.8° From EL Site)
MEAN ERROR (DEGREES)
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-9
-5
-2
0
2
5
9
AZIMUTH ANGLE FROM EL SITE (DEGREES)

79-34-B-4

TRSB SMALL COMMUNITY MLS (TI)

AZIMUTH STATIC TESTS
VERT CUT AT SURVEY POINT# 727 5 / 15 / 78
X= 526.20 Y=[illegible] Z=[illegible] RANGE= [illegible] TRUE AZ= [illegible]

- MEAN & 2 SIGMA ERROR

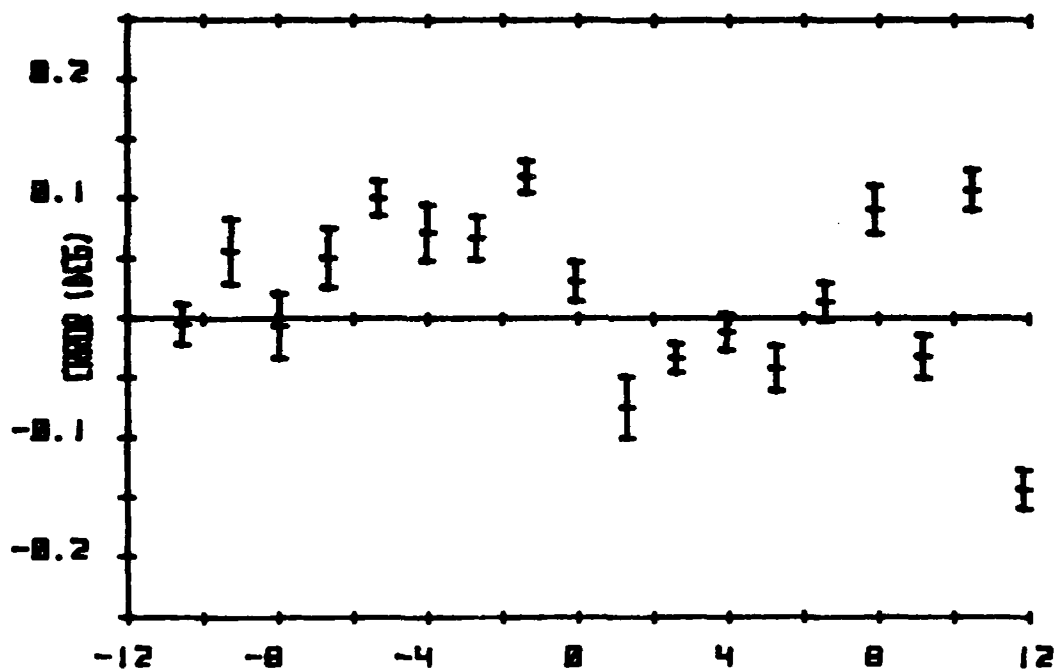


79-34-B-5

TRSB SMALL COMMUNITY MLS (TI)

AZIMUTH STATIC TESTS
CROSS CUT AT POLE HT= 45.00 FT RANGE= 861.28

- MEAN & 2 SIGMA ERROR

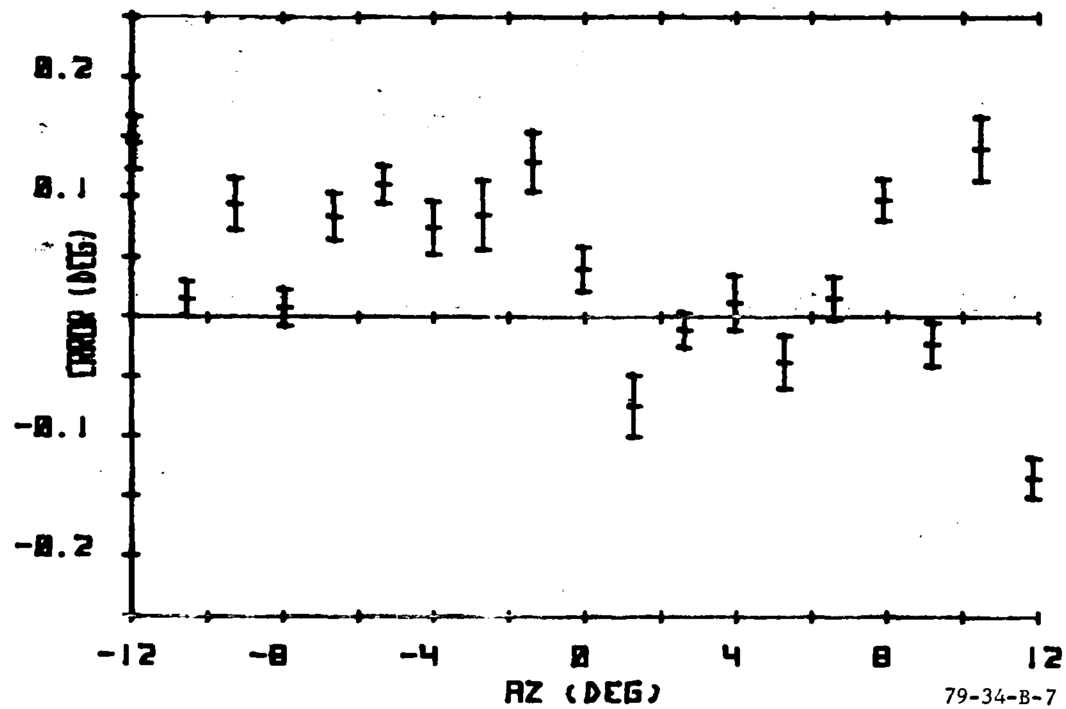


79-34-B-6

TRSB SMALL COMMUNITY MLS (TI)

AZIMUTH STATIC TESTS
CROSS CUT AT POLE HT= 50.00 FT RANGE= 861.29

- MEAN & 2 SIGMA ERROR

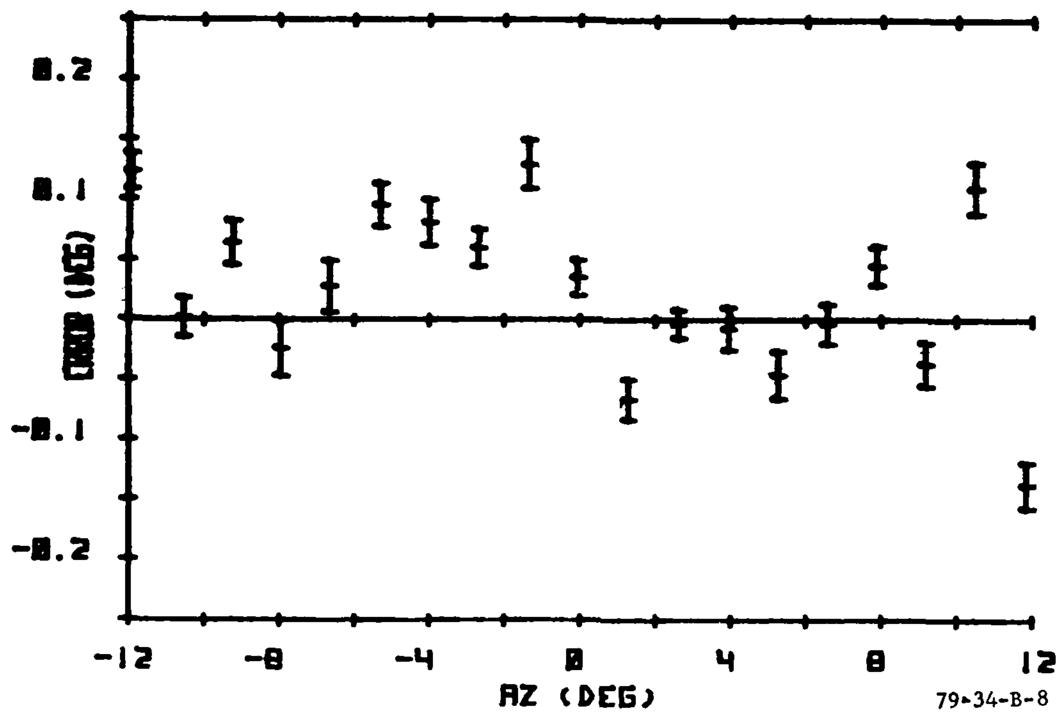


79-34-B-7

TRSB SMALL COMMUNITY MLS (TI)

AZIMUTH STATIC TESTS
CROSS CUT AT POLE HT= 55.00 FT RANGE= 861.28

- MEAN & 2 SIGMA ERROR

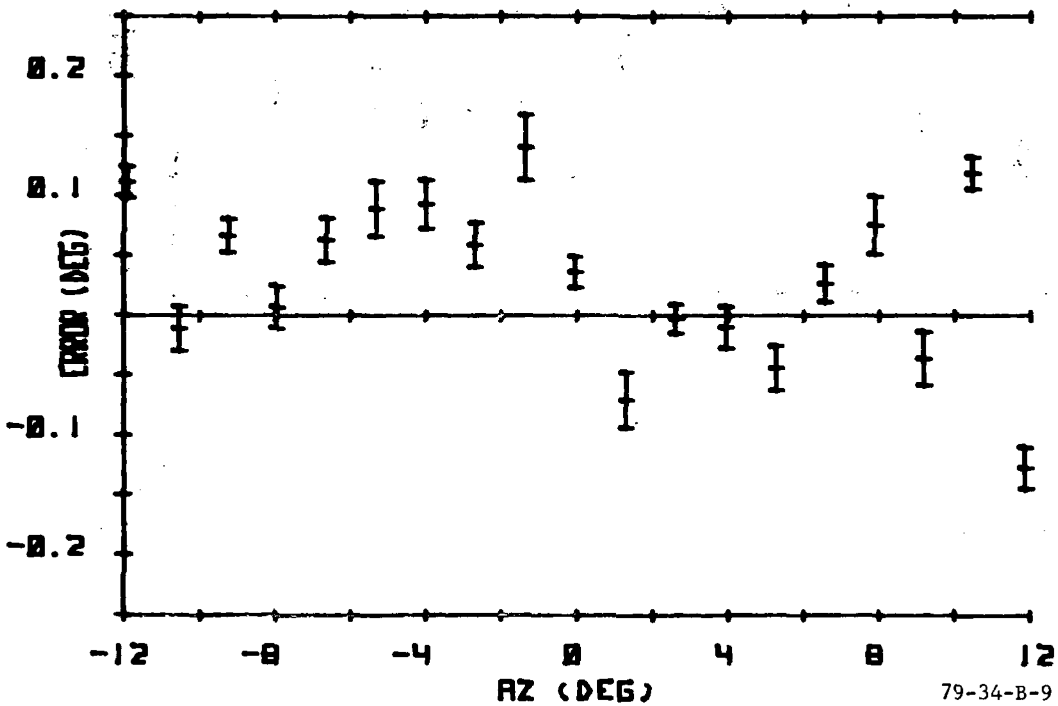


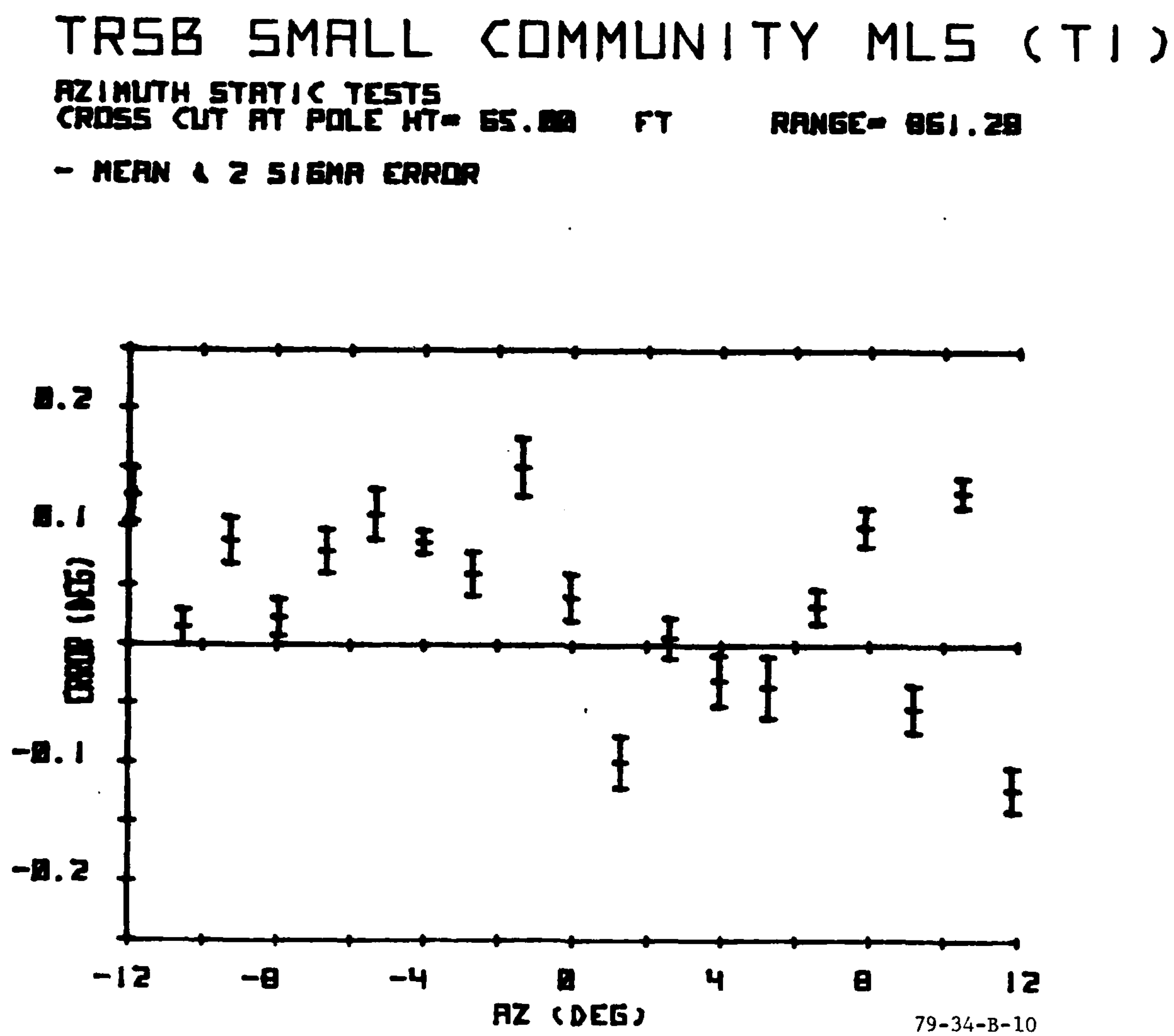
79-34-B-8

TRSB SMALL COMMUNITY MLS (TI)

AZIMUTH STATIC TESTS
CROSS CUT AT POLE HT= 60.00 FT RANGE= 861.29

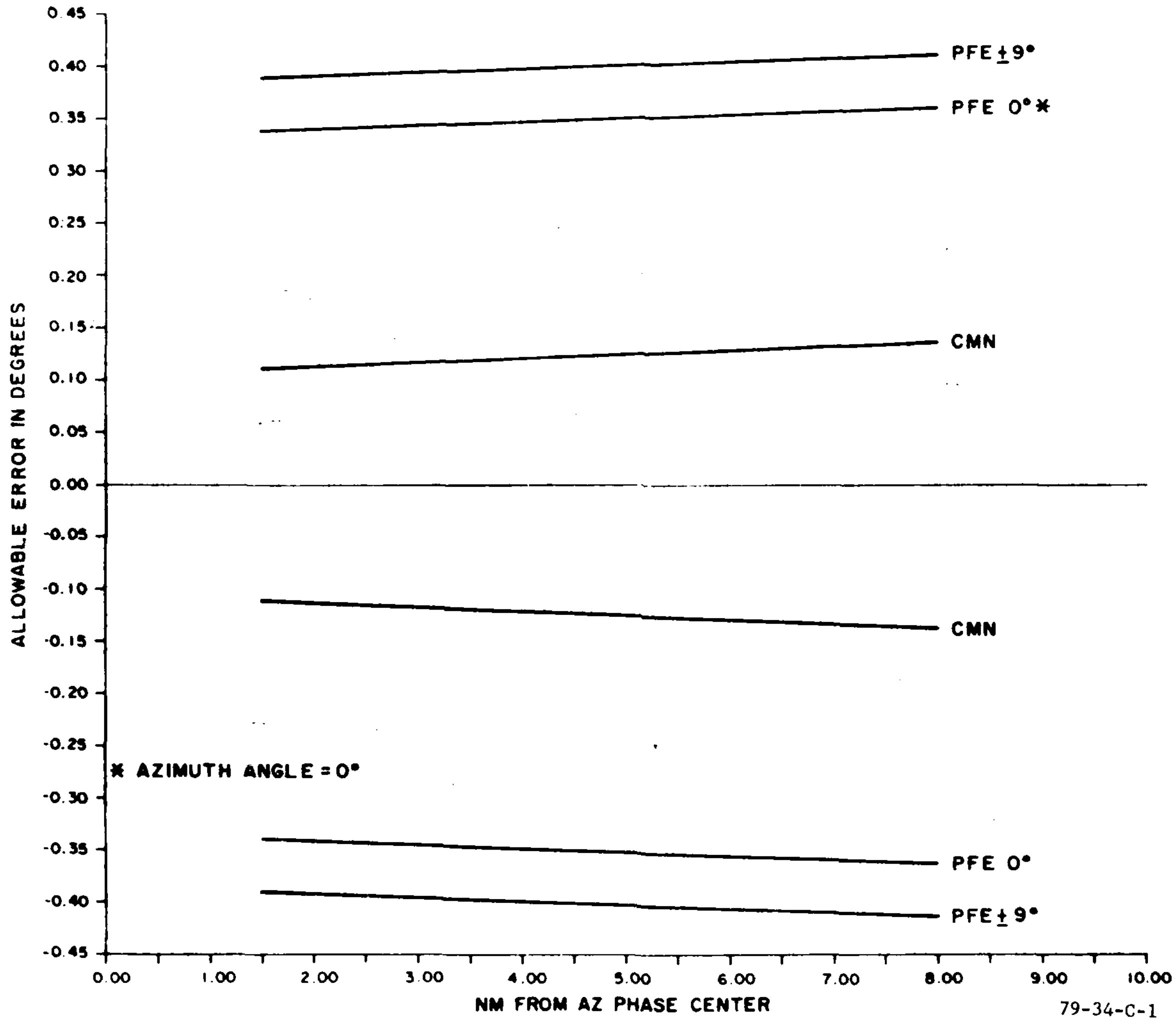
- MEAN & 2 SIGMA ERROR



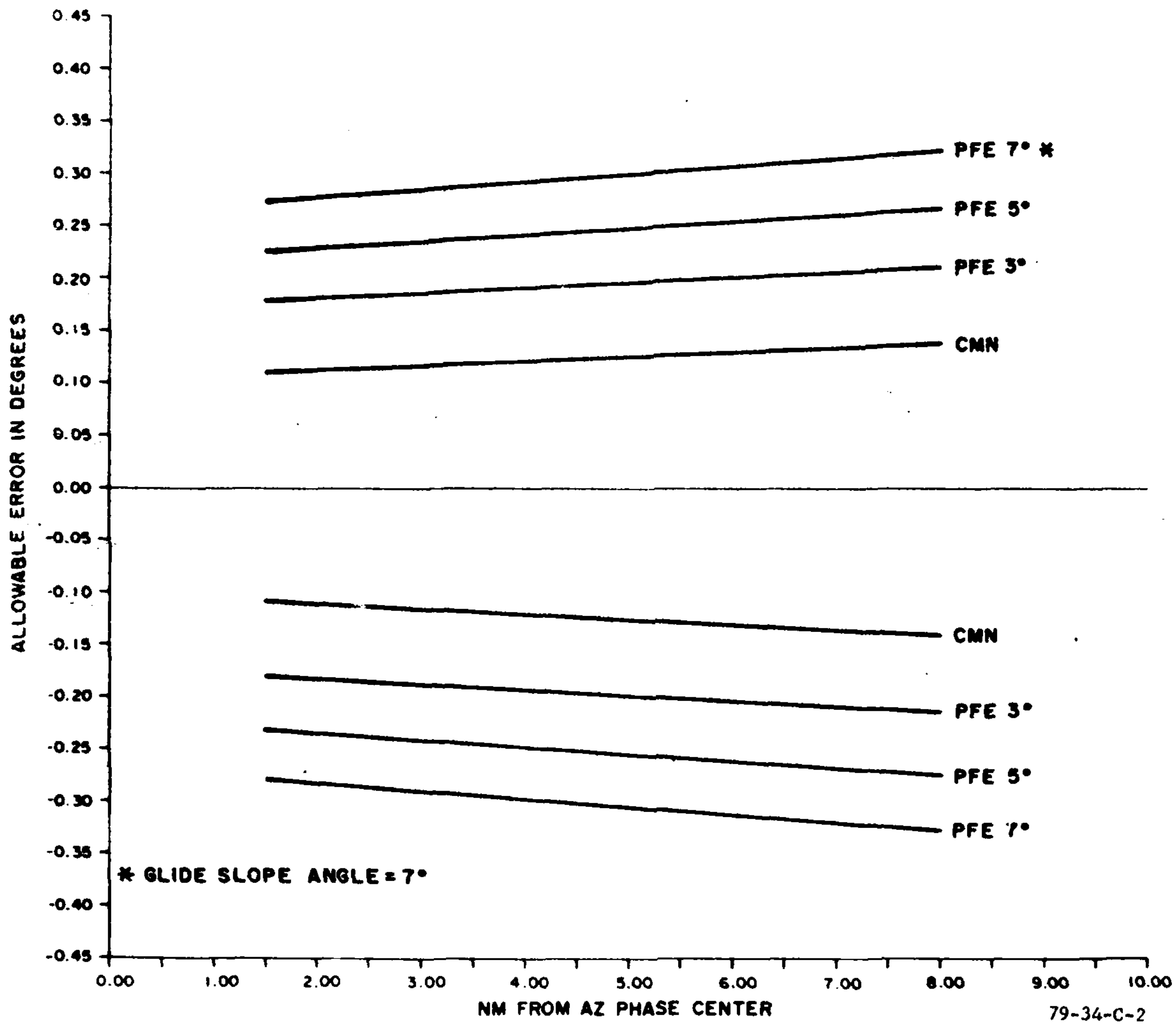

TRSB SMALL COMMUNITY MLS (TI)
AZIMUTH STATIC TESTS
CROSS CUT AT POLE HT= 65.00 FT RANGE= 861.28
- MEAN & 2 SIGMA ERROR
0.2
0.1
ERROR (DEG)
-0.1
-0.2
-12
-8
-4
0
4
8
12
AZ (DEG)
79-34-B-10

APPENDIX C

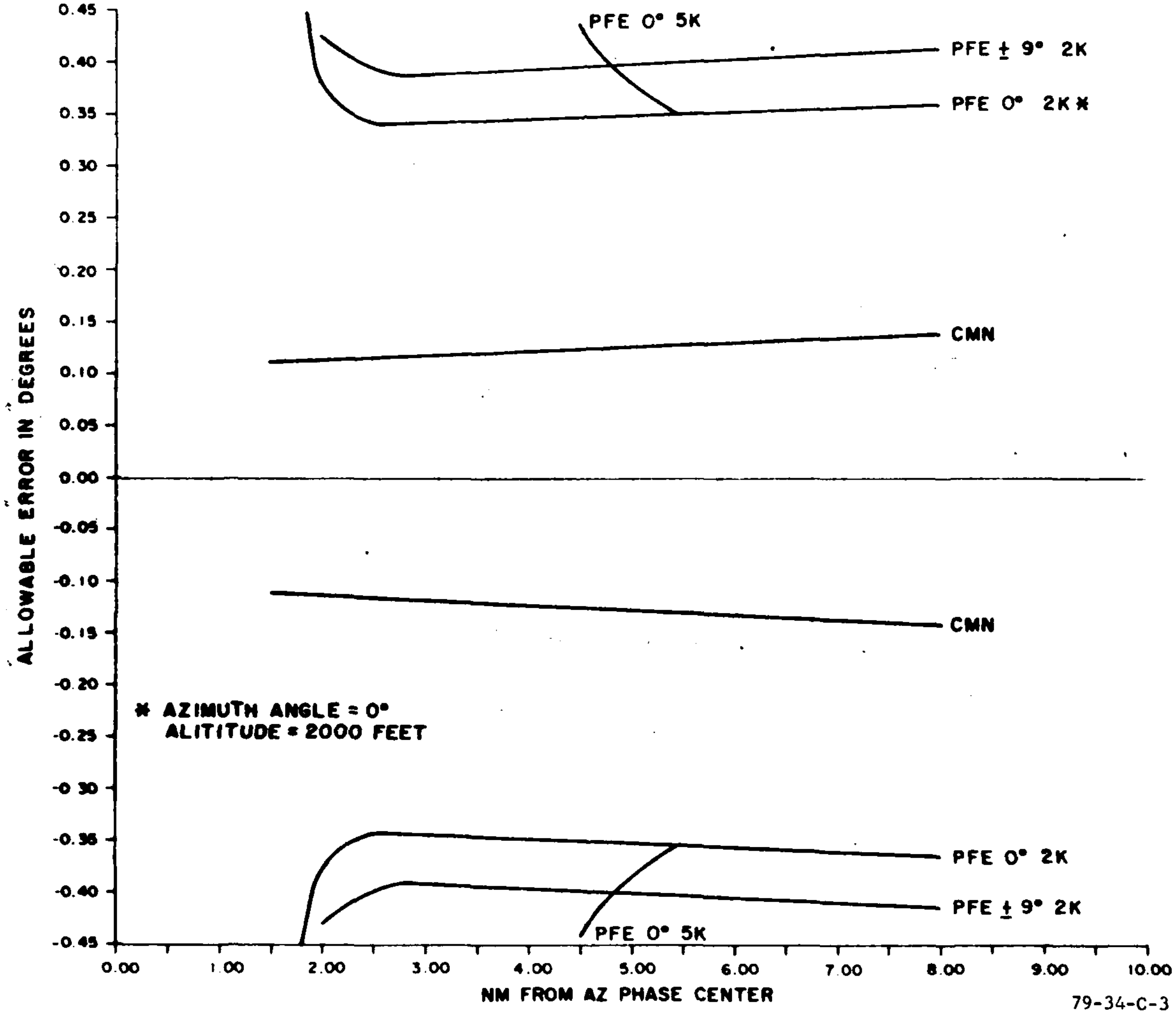
ACCURACY SPECIFICATION LIMITS



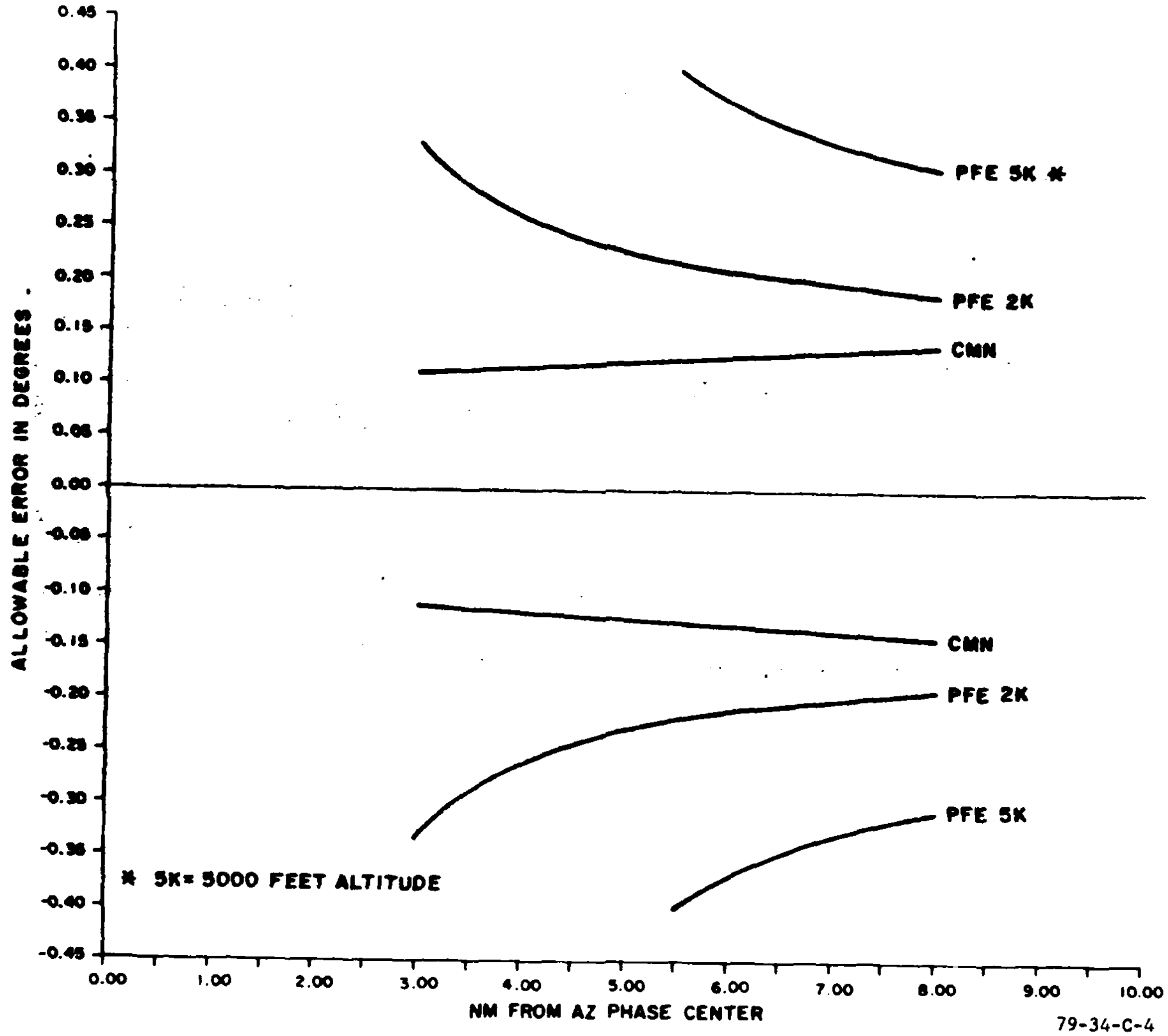
AZIMUTH GLIDE SLOPE ACCURACY SPECIFICATION LIMITS



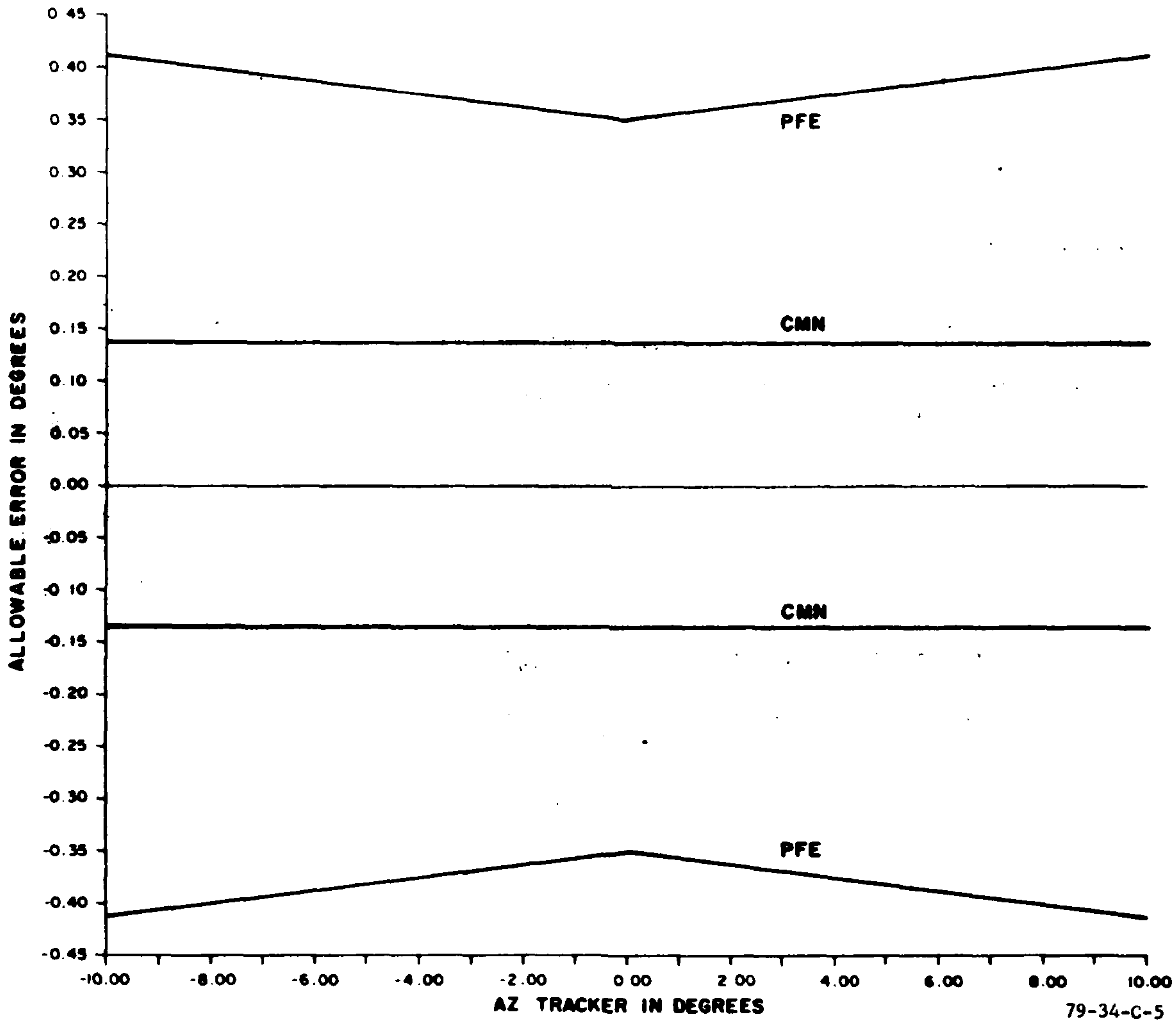
ELEVATION GLIDE SLOPE ACCURACY SPECIFICATION LIMITS



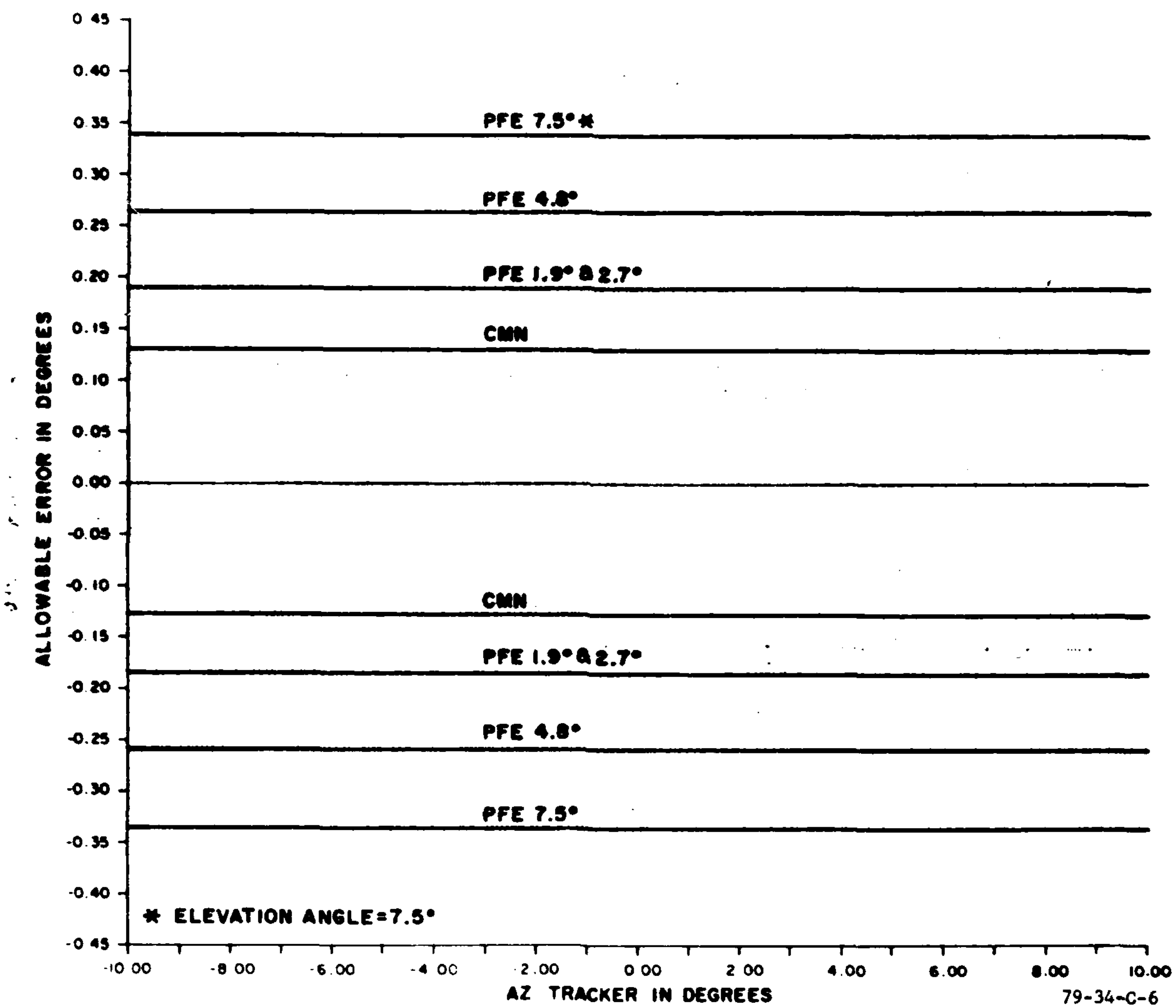
AZIMUTH RADIAL ACCURACY SPECIFICATION LIMITS



ELEVATION RADIAL ACCURACY SPECIFICATION LIMITS



AZIMUTH ORBIT ACCURACY SPECIFICATION LIMITS



79-34-C-6

ELEVATION ORBIT ACCURACY SPECIFICATION LIMITS